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MANUFACTURING SHIP'S VENTILATOR COWLS

By H. E. McCauley

Sheet-metal work is an important item in the construction and equipment of the modern steamship. Parts shaped by hammering are perhaps the most difficult to produce. This article covers in a general way the sheet-metal shop of the Sun Shipbuilding Co., Chester, Penn., and specifically the manufacture of American-type ventilator cowls. The following matter was especially prepared by the foreman of the sheet-metal department for the American Machinist.

ONE of the editors of the *American Machinist* recently told me that the Sun Shipbuilding Co. made the "cleanest, neatest, slickest" ventilator cowls he had ever seen and asked me to tell how it is done. So here goes:

Very few outsiders have any idea of the enormous amount of sheet-metal work entering into the construction and equipment of the average ship. The articles made of sheet metal for use on shipboard are many and various. Some of the parts of this material, such as liners for bearings, are simple flat pieces of sheet metal or brass and require very little skill to produce. Others are more complicated and require considerable skill not only in their making but in laying out the patterns or templets that are used to expedite their production in quantities.

In the headpiece, Fig. 1, is shown a view of the exterior of the sheet-metal shop and storage space for some of the finished work for which at that time there was no room under cover. Unfortunately the illustration does not convey the storage space as it appeared to me at the time the photograph was taken. The air ducts in the foreground are up to 3 ft. in diameter and the two large ventilator cowls at the back of them stand 8 ft. above the ground. The wide variety of work is also not conveyed by the illustration. There are ventilators by the dozens, with mouths from 12 to 84 in. diameter, oil tanks, waste cans,

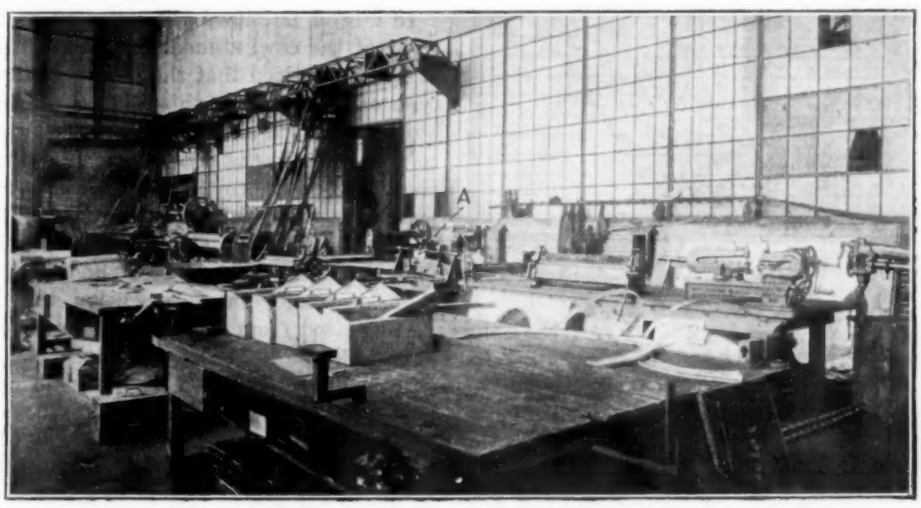


FIG. 2. PART OF THE SHEET-METAL DEPARTMENT

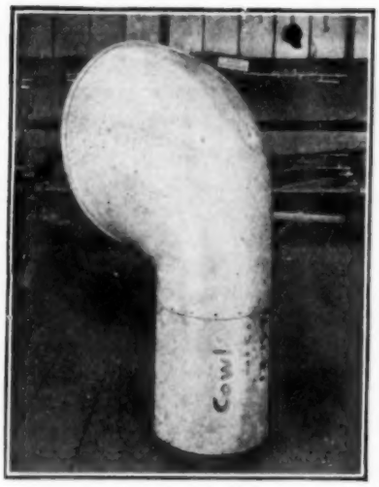
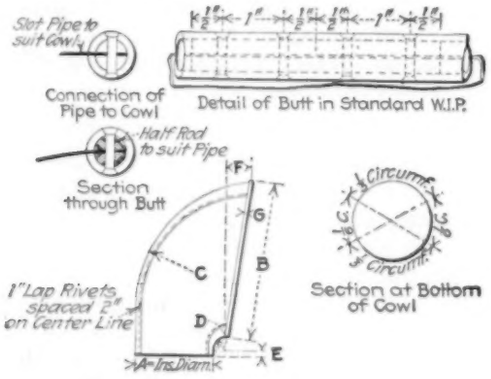


FIG. 3. AMERICAN-TYPE VENTILATOR

bilge strainers and scores of other articles made by the sheet-metal worker. Some of the work, such as ventilators, is standard, for a ventilator of a suitable size for a certain location on one ship will suit the same location on another ship of the same size. Other items are special, being made to suit particular conditions on the ship for which it is ordered or the whim of one of the officers. Where single special pieces are ordered the work is usually laid out directly on the stock used in its construction, but where quantities of the same piece are to be made templets or patterns are made, usually of sheet metal but in some cases of heavy paper or pasteboard.

In Fig. 2 is shown a small part of the interior of the sheet-metal department, a number of the machines and some of the benches with work in progress. An item of considerable importance, as it cut down machine


Slot Pipe to suit Cowl
Connection of Pipe to Cowl
Detail of Butt in Standard W.I.P.
Half Rod to suit Pipe
Section through Butt
1" Lap Rivets spaced 2" on Center Line
A = Ins. Diam.
Section at Bottom of Cowl

SCHEDULE OF SIZES

A	B	C	D	E	F	G	GAGE	RIVETS	REMARKS
6"	12"	9 1/2"	1 1/2"	1"	1 3/8"	1/4" STD. W.I. PIPE	#22 U.S.S.G.	4 #	
9"	18"	14 1/2"	2"	1 1/2"	2 3/8"	" " "	#20 " "	4 #	
12"	24"	19"	2"	1 1/2"	3 3/8"	" " "	" " "	4 #	
15"	30"	24"	2 1/2"	1 1/2"	4 3/8"	" " "	" " "	4 #	
18"	36"	29"	3"	2"	5 1/2"	3/8" " "	" " "	4 #	
21"	42"	33"	3 1/2"	2"	6 3/4"	" " "	#18 " "	5 #	
24"	48"	38"	4"	2 1/2"	7 3/4"	" " "	" " "	5 #	
27"	54"	43"	4 1/2"	2 1/2"	8"	1/2" " "	" " "	5 #	
30"	60"	48"	5"	2 1/2"	9"	" " "	" " "	5 #	
36"	72"	57"	6"	2 1/2"	11"	" " "	#14 " "	6 #	
42"	84"	72"	6"	2 1/2"	11 1/2"	1/4" " "	" " "	6 #	

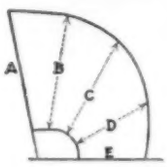
FIG. 4. STANDARD VENTILATOR COWLS, SUN SHIPBUILDING CO.

breakage to a great extent, does not show clearly in the illustration; that is, the marking on each machine its capacity in thickness of sheet steel that it will cut or bend or whatever it may be the duty of the machine to do. One of these labels is shown at *A*, in Fig. 2. It is made of sheet metal painted white and on it in clear large black letters is marked the capacity of the machine as: "Limit No. 10 iron."

As the tools used in the sheet-metal shop are familiar to all who will read this no description of them is necessary, and we can pass directly to the subject of manufacturing ventilator cowls, of which 40 or more go to the outfitting of a single ship.

There are two types of ventilators in common use on shipboard. The type shown in Fig. 3 has the joints crosswise of the length of the cowl (although they cannot be seen either in the illustration or in the work itself), between the sections that go to its make-up. This is usually called the American type of ventilator cowl. In high-grade work all the members except the bottom, or "stem," are shaped by hammering or as it is termed in the sheet-metal shop "bumped out," so that the cowl has a smooth surface which is a continuous curve just as shown in Fig. 3.

In cheap work the members that go to make the cowl are a series of sections of cones, the smaller end of the largest being secured to the larger end of the next smaller, and so on till the smaller end of the smallest is secured to the stem, or bottom, section that enters the cylindrical duct or leader that conducts the air to the various parts of the ship. The outline of a cowl made in



Size of Cowl	A	B	C	D	E
6"x12"	12"	10 5/8"x10 1/4"	8 1/4"x7 1/2"	Thick Size Only	6
9"x18"	18"	16 1/8"x15 5/8"	13 3/4"x12 1/8"	11"x9 1/8"	9
12"x24"	24"	20 1/8"x21 3/4"	16"x18 1/2"	12 7/8"x14 1/2"	12
15"x30"	30"	25 1/8"x27 1/8"	20"x23"	15 7/8"x18 1/4"	15
18"x36"	36"	30 1/8"x30 1/2"	27 1/8"x24 1/4"	21 1/8"x18 3/8"	18

FIG. 6. CROSS-SECTIONAL DIMENSIONS OF AMERICAN-TYPE COWLS

this way is a series of obtuse angles and is not pleasing to the eye, the completed job having the appearance, as a foreman I once knew put it, "as if someone had made it himself." The only excuse for making a cowl this way is either cheapness or that skilled sheet-metal workers are not available.

The other type of cowl is termed the European. When properly made it also has a smooth exterior and pleasing appearance, but the seams run lengthwise. This type is generally used for the larger sizes of cowls with mouths from 36 in. up to 84 in. in diameter or larger. The method of laying out the templets for this type of cowl will be taken up later.

In Fig. 4 is shown the drawing and detailed dimensions of the cowl standard of the Sun Shipbuilding Co. It will be noticed that the drawing shows the European type of cowl, but in this shop cowls up to 18 in. stem by 36 in. mouth are made after the American type. The column of dimensions under *E* is subject to slight change when the cowls are made according to the American type, as it is more advantageous to make the stem a little longer than called for in this column. For instance, I make the stem of the 36 in. cowl 1½ or even 2 in. deep and other sizes below this in column *E* can be increased from ½ to 1 in. The dimensions in column *D* can also be increased slightly.

The diagram, Fig. 5, is first laid out from the sizes given in the table in Fig. 4. For demonstration I have chosen the 18 x 36-in. size. It will be noticed where I have noted the sizes that they differ slightly from those given in the table; this is in accordance with the suggestion given in a previous paragraph.

Lay off the right angle *BAC*, Fig. 5, with the compasses set to 3¾ in.; in the throat radius scribe the quadrant *ADE* from the center *A*. From the point *E* drop a perpendicular *EF* the same length as the figures given in column *E*, Fig. 4, plus the allowance referred to. In this size I add ½ in., making it 2½ in. from *E* to *F*. From the point *F* draw the line *FG* parallel to *EB* and equal in length to the size given in column *A*, Fig. 4. It will be noticed that this size is given as 18¾ in the layout; the extra amount is due to the thickness of the stock and clearance where it fits the duct.

From the center *D* with the compasses set to 36 in., taken from column *B*, Fig. 4, scribe the arc *HI*, Fig. 5. From the center *I* on the line *AC* lay off the point *J* on the arc *HI*, getting the distance from column *F*, Fig. 4. Connect *J* and *D*, Fig. 5. From the point *G* erect a perpendicular *GK*. With the compasses set to 29 in., taken from column *C*, Fig. 4, draw the arc *JLK*, Fig. 5. Step off the line *JLKG* into four equal parts at *MNK*. Then step off the throat-circle line *DEF* into the same number of parts at *OPE*. The points *OM*, *PN* and *EK* are then connected. The lines *JD*, *OM*, *PN*, *EK*, and *FG* are bisected at *QRSTU*, and these are joined by lines as shown. The projection to the left is then made as shown and we are ready to lay out the templets.

In some shops the mouth of the hood is made elliptical, but we make both mouth and stem round. Some shops make their hoods a very pronounced ellipse. This is of course a matter of individual taste, but I prefer ellipses with less difference between the major and minor axes.

In Fig 6 are given the major and minor axes of the elliptical sections we use.

The templet for the stem section marked *I*, Fig. 5, is the simplest to lay out as it is similar to a stove-pipe elbow.

The templets for the other sections marked 2, 3 and 4 are laid out in a different manner from No. 1, but the method employed in laying out any one of the sections 2, 3 or 4 is applicable to other sections.

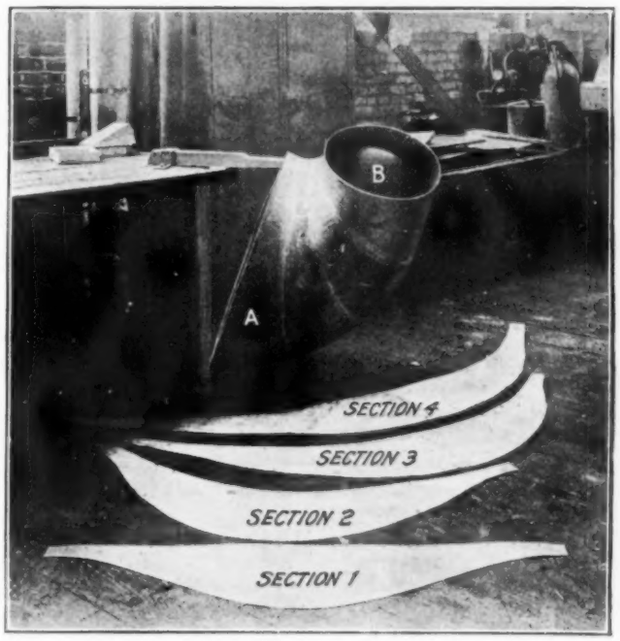


FIG. 8. FINISH-WELDED COWL AND TEMPLETS

The layout for Section 1, Fig. 5, is shown in Fig. 7. The layer-out first draws the horizontal line *AB*, Fig. 7. Near one end of *AB* from the center *C* he draws the half circle *DEF*, which is the same diameter as the stem of the hood, i.e., the distance *DF*, Fig. 7, is the same as *FG*, Fig. 5. He then erects the perpendicular *FG*, Fig. 7, equal to *FE*, Fig. 5, and *DH*, Fig. 7, equal to *GK*, Fig. 5, and connects *G* and *H*, Fig. 7. To the right of *D* on the base line *AB* he lays out a distance *IJ* equal to the whole circumference of the circle *DEF*. The half circle *DEF* is now stepped off into any number of equal parts, in this case eight, and indicated in Fig. 7. The line *IJ* is laid off to the same spacing, 16 spaces in all, as there are eight on each side of the center line. Perpendiculars are dropped from the base line *FD* to the points and other perpendiculars are erected on the line *IJ* in the same manner. The perpendiculars on the line *FD* are now projected on the other side of *FD* to points *Y* on the diagonal line *GH*. Lines are now drawn from the points *Y* parallel to the base line *AB*. The points where the horizontal lines from *Y* intersect with the vertical lines are now connected; a French curve is a handy tool for this. The templet for No. 1 section now appears as in Fig. 7 and also in Fig. 8, where all the templets for the 18 x 36-in. cowl are shown. In Fig. 8 a finish-welded cowl *A* is shown on the ball stake

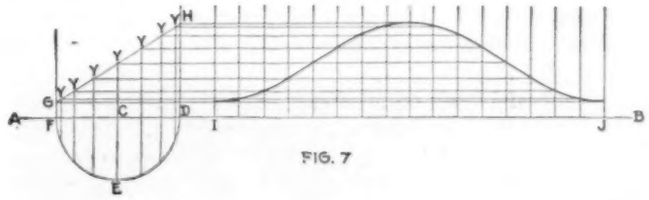


FIG. 7

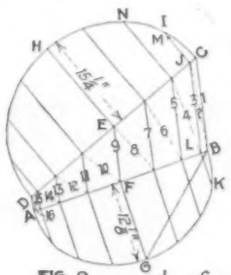


FIG. 9

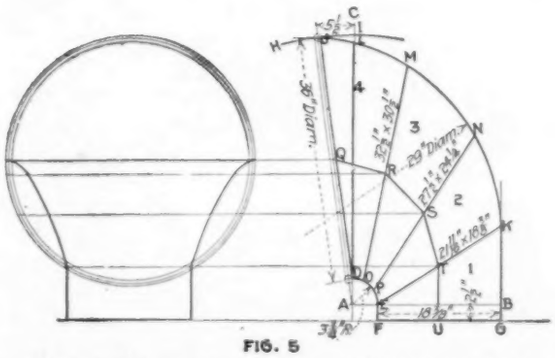


FIG. 5

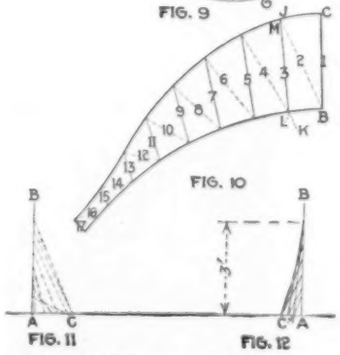


FIG. 10

FIG. 11

FIG. 12

FIGS. 5, 7, 9, 10, 11 AND 12. DIAGRAMS AND LAYOUTS FOR AMERICAN COWL

Fig. 5—Diagram of cowl. Fig. 7—Method of laying out templet for section 1. Fig. 9—Diagram of ellipses for section 3. Fig. 10—Half templet layout. Fig. 11—Dotted-line triangles used in layout. Fig. 12—Solid-line trangles used in layout

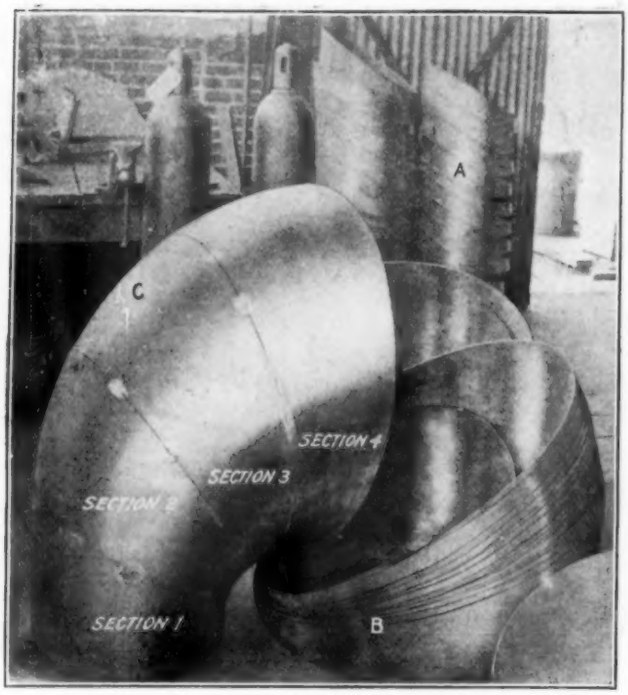


FIG. 13. COWL SECTIONS AND COWL TACKED TOGETHER

B where any dents that it has acquired during the manufacture are taken out. The method used for laying out each of the sections 2, 3 or 4 or, in the case of the 6 x 12-in. cowl which is made in three sections, for laying out the two sections above the stem follows: As an example we will take the section marked 3, Fig. 5. The line *AB*, Fig. 9, is first laid off equal in length to *PN*, Fig. 5. The compasses are then set to the distance *NM*, Fig. 5, and an arc drawn from the center *B*, Fig. 9. With the compasses reset to the distance *PM*, Fig. 5, another arc is drawn locating the point *M*, Fig. 5, on the layout Fig. 9. This point in Fig. 9 is designated *C*. In the same manner the point *D*, Fig. 9, is located, and *BC*, *CD* and *DA* connected by lines as shown.

The line *DC* is bisected at *E*, and the line *AB* at *F*. A perpendicular is erected on *DC*, at *E*, and on *AB*, at *F*. By referring to column C, Fig. 6, it will be seen that the minor axis is 24½ in. Lay-off on the perpendicular starting at *F* a point *G* distant from *F* one-half of 24½ in. or 12⅛ in. The same process is gone through with the perpendicular on *E*, but the point *H* is distant from *E* one-half of 30½ in. taken from the B column, Fig. 6. The layer-out then draws one-half of the 32½ x 30½ ellipse on *DC* and one-half the 27½ x 24½-in. ellipse on the line *AB*. The perimeters of these half ellipses are then stepped off into a number of equal parts, in this case eight, although any even number of spaces may be stepped off. Perpendiculars are then erected on the lines *DC* and *AB* to pass through the points stepped off on the perimeters of the half ellipses. The points where the perpendiculars occur on the line *DC* and those where they occur on the line *AB* are joined by full and dotted lines as shown and marked 1, 2, 3, 4 and so on, in Fig. 9.

We are now ready to lay out the half pattern itself as shown in Fig. 10. We first take the full line 1, Fig. 9 (that is the distance *BC*), and lay it out on the pattern stock shown at *BC* in Fig. 10. We then take the distance *CI*, Fig. 9, and from *C*, Fig. 10, describe an arc *J*, Fig. 10.

Two groups of triangles are shown in Figs. 11 and 12. Those in Fig. 11 are made up of dotted lines while those in Fig. 12 are made up of solid lines.

The length of the dotted line No. 2, Fig. 9, is now taken and laid out perpendicularly on the dotted line *AB*, Fig. 11. We now lay out from the point *A* in Fig. 11 the distance *AC*, equal to *IJ*, Fig. 9, and connect *BC*, Fig. 11. Set the compasses to the distance *BC*, and with one leg set in the center *B*, Fig. 10, lay off *M* on the arc *J*, Fig. 10, equal to the distance *BC*, Fig. 11. Take the distance *BK*, Fig. 9, and from the point *B*, Fig. 10, lay off the arc *K*, Fig. 10.

Now take the length of the No. 3 line, Fig. 9, and lay out this distance on the solid-line triangle at *AB*, Fig. 12. Take the distance *LK*, Fig. 9, and lay it off from the center *J* on the line *JI*, Fig. 9. It will be observed that this length is slightly shorter than *JI*. Mark the point *M*. Set the dividers to the distance *IM* and lay this distance off from the point *A* and at right angles to *AB* in the solid-line triangles, Fig. 12, and mark it *C*. Connect *BC*, and with the compasses set to *BC*, Fig. 12, from the center *M* lay off on the arc *K* the point *L*, which gives the true length of the line 3, Fig. 10.

We next take the distance *IN*, Fig. 9, and repeating exactly as described we lay out the entire half pattern as shown in Fig. 10. The half pattern is then cut out and by turning it over the whole pattern can be scribed off.

The patterns are carefully cut out of sheet steel

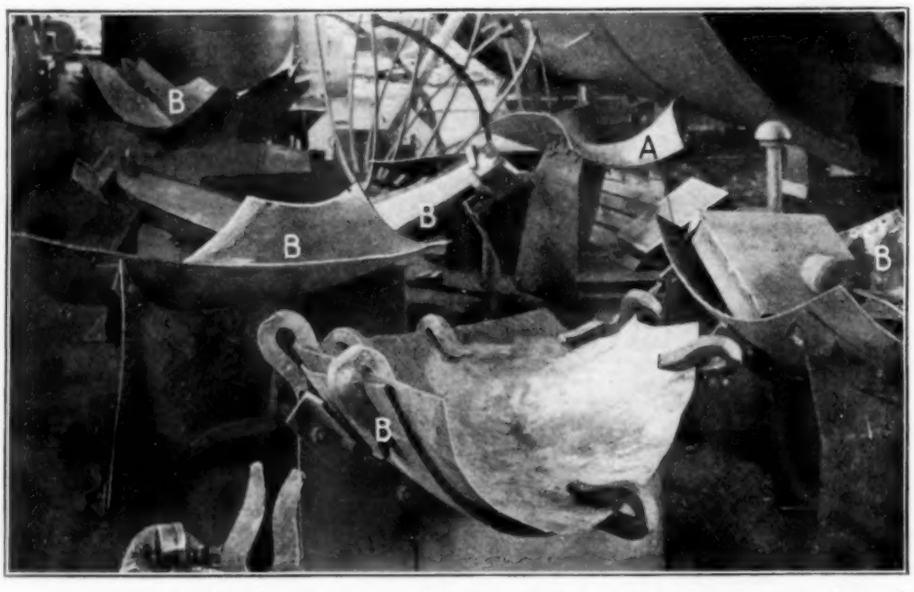


FIG. 14. FORMS IN WHICH COWL SECTIONS ARE BUMPED OUT

and we use galvanized sheet because of its nonrusting properties. The sections are then scribed from the patterns, cut out and welded to form them into rings as shown at *A* and *B*, Fig. 13.

The members shown at *A* are No. 1 sections which are left just as they are welded together, that is to say they are not bumped out. Those shown at *B* are No. 2 sections and after welding they are bumped out to shape them to the curve of the cowl.

At the time when the photographs were taken, larger cowls of the other type were being made so I cannot show the work in progress. Similar forms are used for this work, however, and the description will make the methods clear.

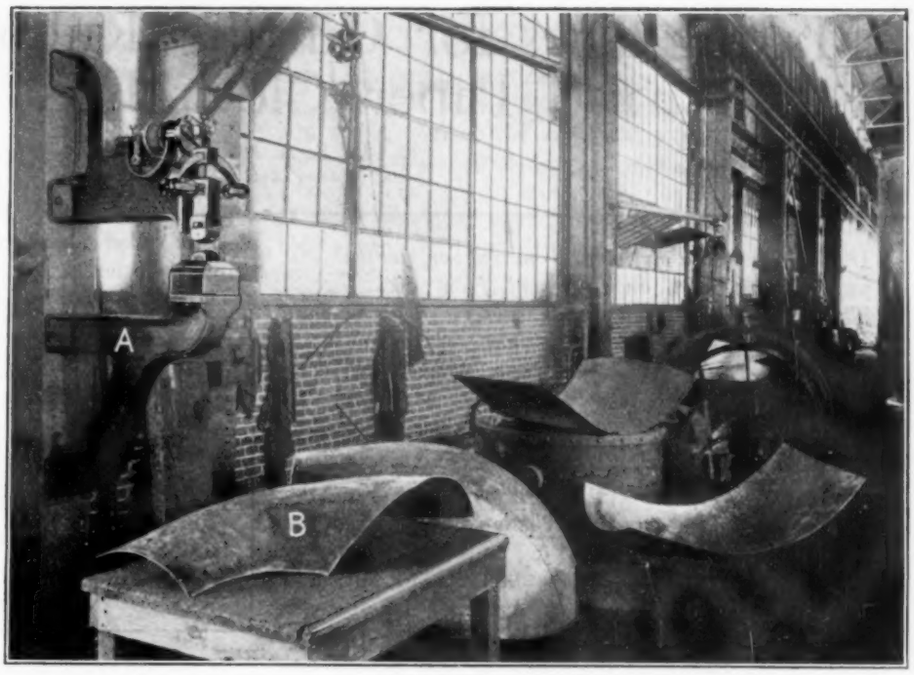


FIG. 15. COWL SECTIONS AND PLANISHING HAMMER

The forms used in bumping out cowl sections are usually of cast iron and made of course from properly shaped patterns. At the time we undertook the manufacture of cowls the pattern shop and foundry were too busy to bother with our cowl-form patterns and castings. We have, however, in the boiler shop, an Italian blacksmith who undertook to forge the forms from ½-in. boiler plates. A number of these forms are shown in Fig. 14. It will readily be seen how the forms shown at *A* and *B* can be used to hammer to shape a section of a size suited to it.

All hammering on the sections is done from the inside. Sometimes the section is heated and hammered while still red hot; at other times it is hammered cold, but just as with all form work in sheet metals it must, whether hot or cold, be soft enough to work, and must therefore be annealed from time to time.

Mallets made of hard wood are used to a great extent to bump out the sections.

When the sections are to shape and as smooth as they can be made with the forms and wooden mallets they are planished with a power hammer shown at *A*, Fig. 15. As previously stated the other type of cowl was being manufactured when these illustrations were made. One of the side sections of such a cowl can be seen at *B* lying on the platform on which the operator stands while at work. It will be noted that the face of the hammer and that of the anvil are well rounded.

When the various sections are shaped to the workman's satisfaction they are "tacked" together with the oxyacetylene torch. This is rather a delicate job as the metal is so thin. The welding wire used is only a trifle over $\frac{1}{16}$ in. in diameter. A cowl so tacked together is shown at *C*, Fig. 13. This method of tacking the sections together before completely welding the seams is made necessary because of the excessive and unequal expansion of the parts which would take place if the entire seam were welded at once.

The short sections of the seam between the tackings are now welded and any dents in the cowl are worked out by hammering over the ball *B*, Fig. 8. The slight ridges formed by the molten welding wire are next ground off and the cowl is either galvanized or painted when it appears like the small cowl shown in Fig. 3. The mouth of the cowl is finished off by pinning on a ring of iron pipe which has a saw slot in it to permit it to be fitted over the sheet metal at the cowl mouth. The size of pipe used for each size of cowls is given in column G, Fig. 4.

Approximating the Tap-Drill Size

BY L. S. WATSON

Referring to Mr. Cox's formula on page 900, Vol. 49, of the *American Machinist* for finding the size of tap drills permit me to draw attention to the fact that it would not work out very well in the case of a United States Standard thread.

For example, take a 1-in. 8-pitch tap: One and one-half times the pitch = $\frac{3}{16}$. 1 in. — $\frac{3}{16}$ = $\frac{13}{16}$ or 0.8125 in. The double depth of an 8-pitch thread is 0.1623 in., and 1 in. minus 0.1623 in. equals 0.8377, which is the correct size of the hole that should be drilled.

Figuring by Mr. Cox's formula it will be seen that 0.025 in. would have to be removed with the tap, which is not very good practice. On a small tap as $\frac{3}{16}$ x 32 pitch the tap would remove about 0.007, which would cause unnecessary loss of time and considerable breakage of taps.

The best method, and one that is within reach of practically all machinists, is to subtract the double depth of thread from the diameter of the tap and use the nearest standard-sized drill available. The double depths of thread can be obtained from a handbook, a chart or the standard-pitch gage that is in the kit of all machinists and tool makers, or it can be figured out as follows: Double depth of thread = $P \times 6495 \times 2$.

Making Dies for Cutting Rubber, Leather, Paper, Cloth, Etc.

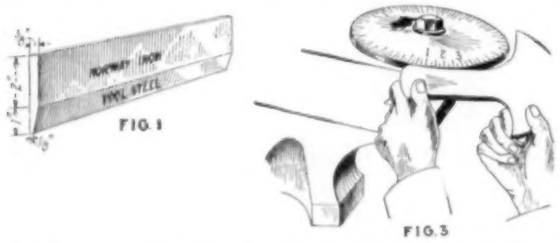
By S. A. HAND
Associate Editor *American Machinist*

Dies for cutting articles from rubber, leather, paper, cloth, etc., are different from dies for blanking metal. They may be described as continuous knives formed to the shape of the piece to be cut. In fact they much resemble the cutters with which our mothers used to cut out gingercake horses for us in our childhood days.

WHEN a die for cutting rubber, leather or the like, of some particular shape, is ordered the customer furnishes the die maker with a heavy paper pattern of the size and shape to be cut, and from this the die maker makes a duplicate out of sheet tin to be used as a gage or templet in making the die.

Dies of the character described in this article are made from bars of composite steel, usually about 3 x ⅜ in. One inch of the width is tool-steel tapering from ⅜ to ¼ in. in thickness, and the remaining 2 in. is Norway iron to which the steel is welded as shown in Fig. 1.

Cutting dies are of two types—machine dies that



FIGS. 1 AND 2. THE STOCK AND THE MEASURING WHEEL

are intended for use in a press and dies that are provided with a handle by which to hold them while they are driven through the material to be cut by blows from a heavy mallet.

To find the length of steel required to make a given die the die forger measures the templet *A*, Fig. 2, around its outer edges with a wheel *B* 1 ft. in circumference and graduated in inches and eighths. This wheel is similar to the one used by wheelwrights for measuring the circumference of wagon wheels to find the length of stock for making tires, but is differently mounted. The die-forger's wheel is mounted loosely on one end of a rod or spindle about 8 in. long and provided with a shoulder near the opposite end.

In use the projecting end of the rod is placed in a hole in the anvil face in an upright position so that the wheel is free to revolve in a horizontal plane. The measurement is taken by revolving the templet while its edge is pressed against the periphery of the wheel, Fig. 3. The bar of steel is then cut off to the length so obtained plus an allowance for the weld, which is usually about ⅛ in. for the average die.

For finding the bending points the bar is held in a fork on the anvil and the edge of the templet held against it near the end as shown in Fig. 4. The templet is rolled along the bar until the first bending point is reached. Its position is marked on the bar with a soapstone pencil and then scored lightly with a chisel.

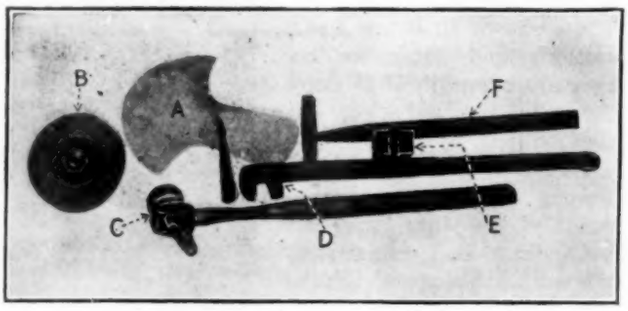
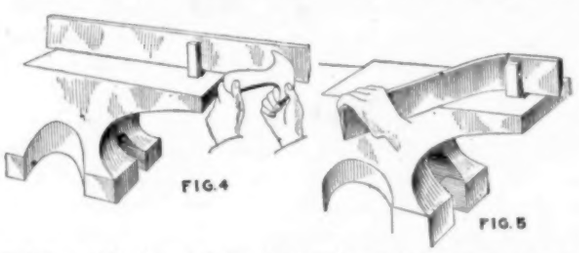


FIG. 2. SOME DIE-FORGER'S TOOLS

After heating in an open fire the bar is cooled on each side of the chisel mark by local application of water, leaving enough of the length hot to make a bend of the desired radius.

In making the bend the bar is held in a bending fork fitted in the hardy hole in the anvil and one end pushed or pulled around by hand, Fig. 5. It is surprising how near a skilled die forger will get the bend to the proper radius and angle at the first try. However, in order to get the bend to fit its corresponding part of the templet, he may have to push or pull the bar one way or the other while changing its position in the bending fork or hammer it on the horn of the anvil or on a stake, similar to the kind used by tinsmiths, of which he has many of various sizes and shapes.

The next bending point is located as before except that at the start the templet is held with its corresponding part in the bend already made before rolling it along the bar. The second bend, unless it be a very



FIGS. 4 AND 5. LOCATING AND MAKING FIRST BEND

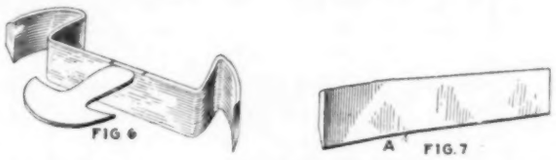
sharp one, is made in the same manner as the one just described.

For making sharp bends a machine very much like a miniature bulldozer is used. It is fitted with a pair of V-dies, and being hand operated it can be stopped at any point of the stroke so that the angle of the bend is under perfect control. A very good bend of large radius can be made on this machine by making a series of slight bends at several points.

At some stage of the bending process, depending on

the size and shape of the die, one end is scarfed for the weld. After making all the bends on one half of the bar, except the bend necessary for bringing the ends together, the previous operations are repeated on the other half.

By fitting the templet to the bend at one end of the bar and rolling it toward the center the position



FIGS. 6 AND 7. CLOSING BENDS AND BENDING TO PREVENT BUCKLING

of the closing bend, Fig. 6, is found and marked. In making short bends which curve outward it is necessary to first heat the bar where the bend is to be made and give it a slight bend in the direction of its width as shown at *A*, Fig. 7. If this is not done the cutting face of the die would have low spots at the bends, due to unequal lines of compression on the tapered steel portion of the bar. After making the closing bend by which the two scarfed ends are brought together, they are welded. By the use of borax and a patent welding compound as a flux the weld is made at a very low heat, avoiding danger of burning the steel. It is generally the practice after welding to reheat the weld, apply the flux and hammer it again. This is done to insure a good weld in the steel part of the bar.

Upon completion of the weld it is necessary to do some refining to bring the die to the contour of the templet, leaving sufficient stock for the grinding and filing operations which follow. This is accomplished by local heating and cooling, tapping in various places and directions with a hammer, gently here and hard there, all depending on the intricacy of shape, the amount of correction necessary and the relative location of the part to be corrected. A detailed description of this procedure is impossible and the actual performance must be seen to be appreciated, as every move made is purely the result of judgment and skill, and I very much doubt if the most skillful die forger could describe the process or tell the how or why of the many things he does in refining the shape of the die.

Fig. 8 shows a die after leaving the hands of the forger. Its accuracy of size and shape is truly remarkable.

Grinding

After the forging process has been completed the top of the die is rough-leveled and the outside rough-ground on a grindstone, particular attention being paid to the condition of the weld after the scale has been removed. It is then taken to the bench, where the templet is applied and its outline scribed on the cutting face. Next it is "buzzed," or ground, Fig. 9, on the inside to remove the surplus stock. This is done by a small wide-faced abrasive wheel running at a very high speed.

From the buzzer the die goes back to the bench to be filed on the inside to the lines, after which the grindstone removes the surplus stock from the outside.

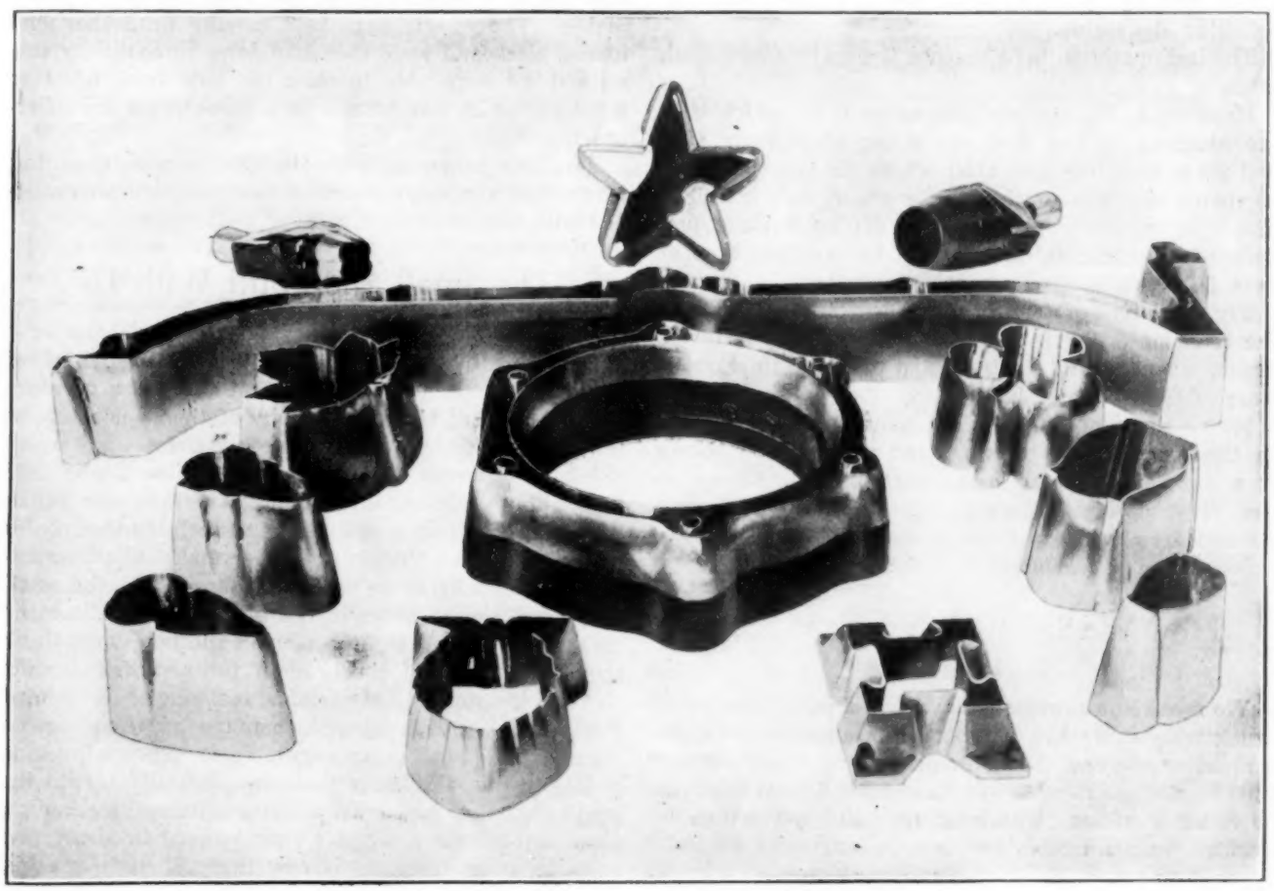


FIG. 11. SOME FINISHED DIES

The heating for both hardening and tempering is done in an open hard-coal fire and the quenching in cotton-seed oil. The temper is drawn to a light blue.

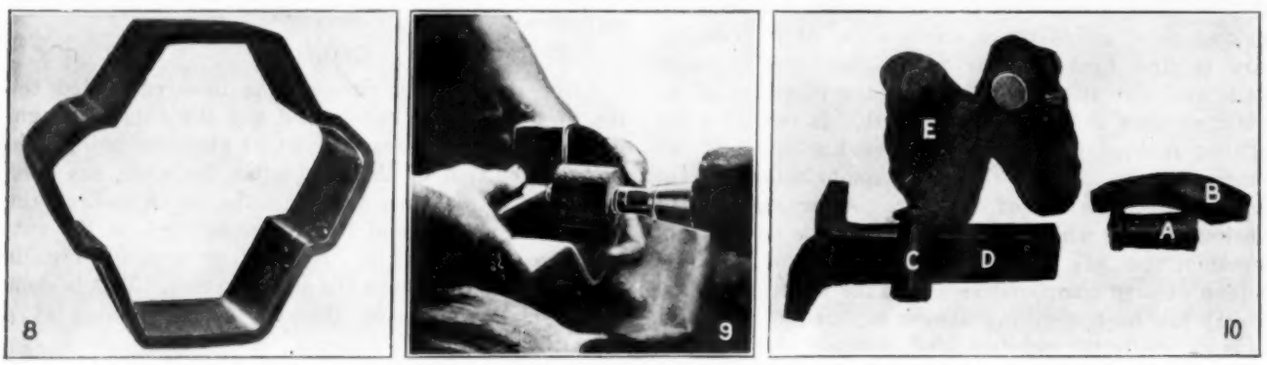
The next operation is to level the cutting face on a disk grinding machine, after which the die goes back to the bench to be filed on the inside for correction of any distortion that may have taken place in hardening; the grindstone is then used to bring it to the proper height by grinding on the back and to rough-grind the cutting edge on the outside. After this the kinks and curves on the outside, which could not be reached by the grindstone, must be filed so as to bring the cutting edge to the same thickness at all points. Then it is polished on the outside with an ordinary polishing wheel, the kinks being touched up with a very small wheel running at high speed, which is also used for polishing the inside.

The last operation is to sharpen the cutting edge with a file.

Handles *A*, Fig. 10, and the bases *B* by which they are attached to the dies are made of Norway iron and are welded together, after which the base is forged as shown at *E* to suit the die for which it is intended. The base part is attached to the die by welding just before hardening. *C* is a handle for another type of base *D*, which is shown partly finished.

Fig. 11 shows a few of the types of dies made by the Hoggson & Pettis Manufacturing Co., New Haven, Conn., where the illustrations and data for this article were obtained.

Every shape of die calls for some special treatment in the course of its making, and anyone who thinks it a simple matter to make such dies as shown in the illustrations is greatly mistaken, as the whole process from start to finish is one that requires long experience and consummate skill.



FIGS. 8 TO 10. A DIE, "BUZZING" AND SOME HANDLES
Fig. 8—A die as it leaves the forger's hands. Fig. 9—Buzzing the inside of a die. Fig. 10—Die handles

How We Saved the Truck Wheels

By J. Thomas

We received a contract to machine a large number of truck wheels for gun carriages for antiaircraft guns, and after we had finished up a number with bronze bushings it was decided to change from bronze bushings to roller bearings. The bushings being quite thin we decided we could bore them out quicker than we could force them out.

The job was let to an outside shop to remove the bushings and enlarge the hole to the proper size. Upon inspection, after the wheels had been returned, we found that they had all been reamed with a reamer that had cut over size, so that the bushing for the roller bearing would just slide through. The stock was a special alloy steel furnished by the Government and it meant a serious loss to us, besides delaying the production of the gun carriages. To get over the matter we decided to try to close the hole by shrinking, which proved successful.

We had the blacksmith heat the truck wheels to a dull red, then, placing them on a rod laid across the cooling tank, we rolled the rod back and forth on the edge of the tank, allowing the outside and flange of the wheels to come in contact with the water. This cooled the outside quickly, causing it to close on the still red-hot center. The wheels were kept moving until they had turned black and were then laid down to cool. By this method we were able to close the hole from 0.004 to 0.006 in., which was enough for a force fit for the roller-bearing shell.

This was taken up with the Government inspector, who by the way was a practical mechanic, who was satisfied with the job.

The Small Shop Still With Us

By M. L. Lowrey

From reading the *American Machinist* and kindred publications one gets the idea that there are no more small shops, but there are—many of them—not only in the small towns, but also in the big cities.

I have observed that many of those men who hold responsible positions in big shops are men who began life in the small ones, and I have noticed too that copies of the *American Machinist*, *Power* and similar periodicals are usually to be seen lying around in the small shops and almost never in the big ones. I believe the reason for this is that the men in the big shops think they are already at the head of the procession, while those in the small country shops, realizing their isolated position, try to keep up with their trade by reading the experiences of others and applying the knowledge thus gained to the solution of their own difficulties, with the result that they are usually better all-round mechanics, more self-reliant and more successful than those who work to a set form, as is now the custom in the big shops.

XIV. The Radiator, Locking Piece and Magazine

This final article deals with reaming and gaging the radiator, the manufacture of the rear locking piece by which the radiator is secured to the gun and some operations on the magazine pan and center. The tools illustrated are jigs and gages, together with some ingenious devices for milling and profiling awkward forgings.

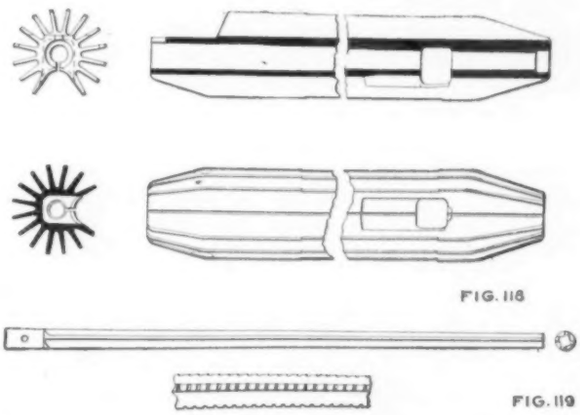
THE radiator, as pointed out in earlier installments, must be an exact fit to the taper exterior of the barrel, otherwise full and complete radiation of heat will not be secured. Consequently, great pains are taken to finish the taper bore so as to assure proper fitting to the barrel throughout the entire length.

The radiator outlines are shown in Fig. 118. The material is aluminum and the radiator is formed with a series of longitudinal vanes extending the full length. The aluminum body when finished is secured in a steel casing, and the latter is fastened to a steel member known as the radiator-casing locking piece, by means of which the radiator is secured in place on the gun.

The details of assembling and method of mounting in position will be seen by referring back to the sectional views presented in the first section of this series of articles.

It is not purposed here to show all of the operations connected with the manufacture of either the radiator or the locking piece, but enough will be described to convey an idea of the character of the work in general and to show something of the special tools found necessary for the work.

The bore of the radiator is finished to diameter and correct taper by application of roughing and finishing reamers and tested by a long plug gage representing in its dimensions and degree of taper the size and taper of the barrel. The barrel must fit snugly the full length without forcing either end of the hole in the radiator, and therefore the requirements in reaming the



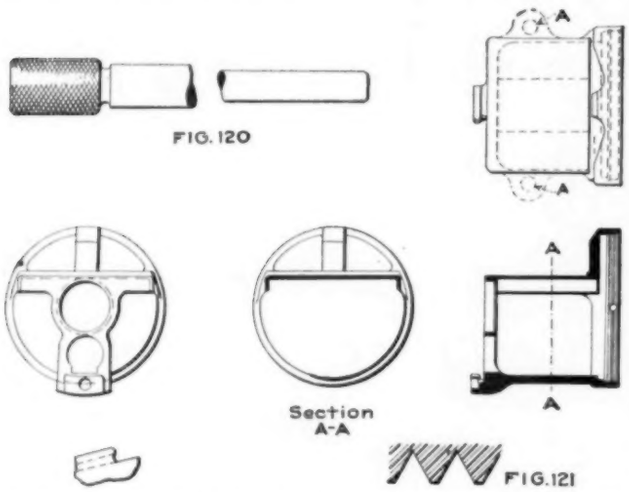
FIGS. 118 AND 119. THE RADIATOR AND THE ROUGHING REAMER

Fig. 118—The radiator. Fig. 119—The roughing reamer for the radiator

bore are most exacting. The type of roughing reamer used for the first reaming operation is illustrated by Fig. 119, which shows clearly the form of notch used in serrating the cutting edges of the teeth. The reamer has a total length of $27\frac{11}{16}$ in. and has four teeth around which a left-hand helix is cut.

The taper-plug gage for testing the bore after finish-reaming is shown in Fig. 120. This gage is applied to the bore after coating the gage surface with prussian blue. With such a long taper plug it is impracticable to attempt to slip it into place as with shorter gages, owing to the likelihood of the gage contacting accidentally with some portion of the bore before being

properly entered. So the practice is to place the radiator upright and allow the gage to enter the hole until within a few inches of depth, but of course without touching any portion of the walls. Then the plug is released from the hand and allowed to drop the remainder of the distance. It falls straight to its seat along the taper bore, and when removed the character



FIGS. 120 AND 121. TAPER PLUG GAGE AND RADIATOR LOCKING PIECE

Fig. 120—Taper plug gage for radiator. Fig. 121—Rear locking piece for radiator casing

of the contact is defined by the condition of the marking material with which it is coated.

The casing for the radiator screws into the locking piece as shown in Fig. 121. This is a high-grade steel forging machined in a number of operations, the sequence of which is covered herewith.

The casing is permanently assembled to the rear locking piece, which is machined on top to form a flat platform to serve as a guide for the magazine, while at the bottom it forms a link between the barrel and receiver groups. It is therefore bored through the rear wall to form an opening to fit over the barrel, and immediately below is another hole for the piston.

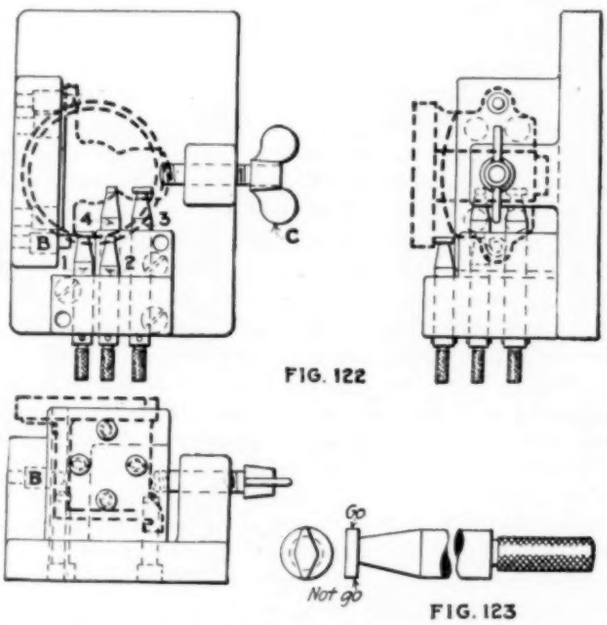
The forging is made with two lugs on the sides, as indicated by the dotted projections *A*, which are drilled and used for positioning the work in various fixtures until all machine operations have been completed up to the point where the under side of the table is to be profiled, and the lugs are then cut off, after which the profiling operation mentioned is accomplished, leaving only a few more stages through which the piece must pass to completion. These subsequent operations are mostly filing and simple counterboring cuts that do not require the locating lugs for holding the work in a given position for satisfactory accomplishment.

Only a few of the entire series of operations and the tools therefor are illustrated here. The first machine cut is the rough-milling preliminary to milling the surface on top of the table. The latter operation leaves stock for finishing later on. Then the locating holes are spotted, drilled, reamed, burred and used for positioning the forging for the operations that follow. Both front and rear ends are now milled; then the inside is profiled to shape by working from both right and left sides. The work is placed by its locating holes and milled to shape by the aid of suitable profiling fixtures. These are not shown here, for many profiling devices of more or less similar character have been fully described in previous articles in this series.

The test gage for the inspection of the work after these cuts is illustrated in Fig. 122, this drawing showing the gage for testing the profiling from the right-hand side. The tool carries four gaging members with knurled handles and with wing contact points at the inner ends of the spindles. The profiled forging is placed as indicated by the heavy dotted lines, with the table face in vertical position and the locating lugs slipped over two closely fitting plugs shown at *B*, where they are fitted into the corresponding face of the gage fixture. A thumbscrew *C* is set up lightly to press the work against four hardened stop feet and secure the work in the fixture and the four contact gages 1, 2, 3 and 4 are then slid into forward position and rotated easily by the fingers to test the accuracy of the profiling cuts. The contour surfaces with which these gages contact will be noticed in the dotted outline in the side view of the fixture. The plan view shows the different positions from the center line of the respective portions of the interior to which the gage wings are applied in the test.

One of the gage spindles is seen in Fig. 123, and it will be noticed that the contact points are made on the limit principle, one end of the wing being marked "Go," the other "Not Go."

Several hand-milling operations and a straddle-milling cut are now taken to form the shape over the locking lug and rough the locking face and mill the radiator



FIGS. 122 AND 123. A PROFILE-TESTING GAGE AND ONE OF THE SPINDLES

Fig. 122—Gage for testing profile of radiator rear locking piece. Fig. 123—One of the gage contact spindles

brace (see Operations 10 to 13), then in Operation 14 the hole for the barrel is drilled and reamed and the rear end faced. Operation 15 consists of boring the face, reaming the casing hole, turning the outside to size and tapping the radiator-clearance hole. This is a roughing operation, and Operation 15½ which follows

finishes the foregoing surfaces. Operations 14, 15 and 15½ are accomplished in a turret lathe.

The gaging fixture in Fig. 124 is used to check the accuracy of the last-named operation. The work is located here, as in previous gages, by placing it over hardened position pins *F*, which fit closely in the two locating holes, and here it rests as before upon four plugs or feet *G*, upon which it is drawn down by the straps and thumbscrews at either side. Plug *H* is then pushed into the hole bored for the barrel. The plug is therefore a close fit and will not enter the bore at all unless the hole is correct as to size and in exact position.

The facing of the rear end of the locking piece is tested by the three fixed micrometer heads *K*, the spindles of which are run in to contact with the face of the work to be inspected. The gage spindle *L* is fitted to carry the limit-gage contact piece *M* in the form of a wing. This gage tests the undercut at the point indicated in the drawing where the gage is turned with the short arm of the head in contact with the surface of the work. The position of the work in this gaging fixture is clearly shown by the outline of the forging in the various views.

The gage used in connection with Operations 15 and 15½ is represented by Fig. 125. The work is located and held in this gage in exactly the same manner as described in connection with Fig. 124. The gages *B* are of the flush-pin type with limit shoulders ground on the end.

A Drilling Jig

The jig in Fig. 126 is for drilling and reaming the piston hole and certain other holes and the work is held as shown. It is placed over position studs in the vertical jig face at *A* and clamped against the six hardened feet *B* by hook bolts *C* which are drawn back by wing nuts *D*. The knurled piece *E* is a short length of pipe screwed into the jig base for convenience in handling the work. The work is still further secured and supported by the hardened clamp *F* at the front,

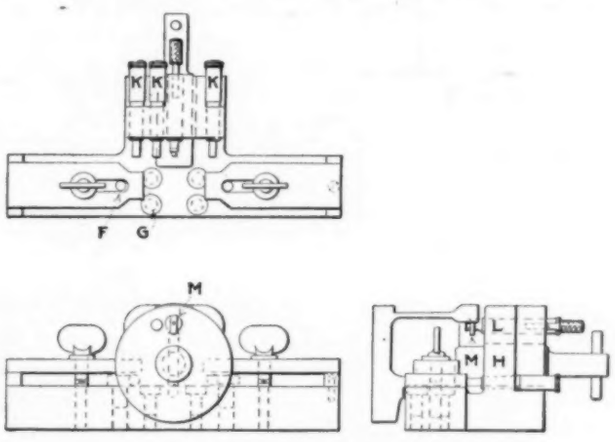


FIG. 124. A MICROMETER GAGE

which is pressed back by the thumbscrew *G*. The latter is tapped through a pivoted leaf *H* which is mounted upon a pin at one side and held closed by a button *J* which is turned to clear the slotted end of member *H* when the jig is opened to allow the work to be entered or removed. Part *H* carries two guide pins which serve to retain the clamp block *F* in proper position and so prevent it from swinging about the clamp screw *G* when the jig is opened.

Several of the tools shown are of a type used for the locking piece of both the American model and the airplane guns. The details of the parts differ somewhat in the two constructions, but the tools for

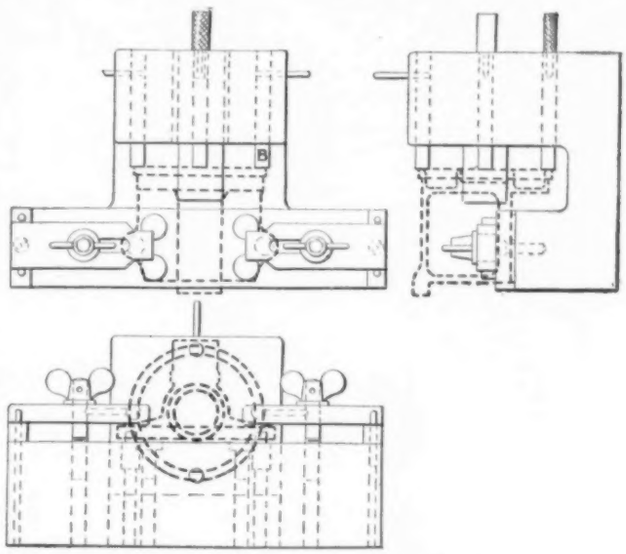


FIG. 125. A FLUSH-PIN GAGE

manufacturing are of the same general design. The gage in Fig. 127 is a tool made specifically for the airplane model. It tests the accuracy of the position of the three holes drilled and reamed in the jig in Fig. 126. The work is located over the two position pins *D* and clamped lightly on its seat formed by the six hardened plugs *C* by two screws *B*, which are provided with large collars and knurled heads as indicated. The collars, or flanges, of these clamp screws are milled away at one side to allow the work to be placed in position and removed by simply turning the screws sufficiently to permit the flatted edges to clear the ends of the piece.

The two plugs *E* for testing the position of the piston hole in the locking piece are a close sliding fit in the hardened and lapped bushings *G*, which are pressed into the uprights of the fixture. The whole gaging fixture provides a very rigid test for the positions of the three holes referred to both as regards their center distances in respect to each other and their heights above the table of the locking piece.

Profiling Fixtures

There are a number of profiling fixtures used for various operations on the locking piece. One of these is illustrated here as having some unusual features that suggest an effective method of machining other classes of work where interior surfaces are to be finished which are difficult to reach with ordinary tools. The fixture is shown on the profiling machine in Fig. 128, and this view also gives a clear illustration of the American model locking piece as it approaches completion. The locating lugs at the sides have not as yet been cut off and certain other cuts remain to be taken, but in the main the piece closely resembles the finished part.

In the illustration the profiling machine is in operation in cutting out along the inside wall of the locking piece and in the corner along the inside of the table. The shape of the form plate under the guide pin of

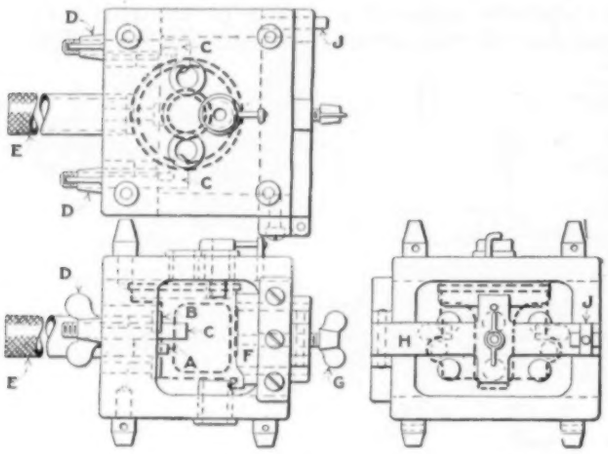


FIG. 126. A DRILLING AND REAMING JIG

the profiling head shows the contour to be milled in the work. The locking piece to be profiled is held in its fixture by locating pins as before and by three hook bolts drawn back by the pin-handle screw at the rear, which acts upon a three-cornered plate so that all three bolts are operated at once and with uniform degree of pressure.

The profiling is done with a small end mill, which is mounted as represented in a short spindle carried in a vertical position at the outer end of a projecting arm with sufficient reach to carry the cutter to the rear end of the work. The drive for the cutter is taken from the regular profiling spindle by a spur gear and a series of small gears mounted upon short shafts or spindles.

The method of mounting the entire attachment upon the profiler head will be understood without explanation.

Following the cutting off of the locating lugs the under side of the table is profiled and then there are

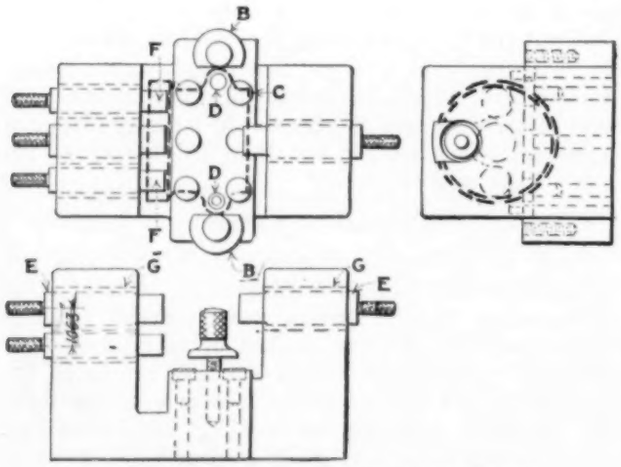


FIG. 127. A POSITIVE GAGING FIXTURE

one or two hand operations, after which the barrel seat is counterbored, the table ground to match the receiver and the locking piece is then ready for hardening and polishing.

The magazine is made up of a sheet-steel pan to which is riveted the cartridge spacer ring carrying the interior separators. Inside the pan is the aluminum magazine center, while outside is the top plate which houses the magazine latch and latch spring. The magazine center and the top plate are fastened together by means of rivets. The wall of the magazine pan is formed with vertical corrugations, which on the inside serve to space and retain the cartridge bases while on the outside they are engaged by the feed, stop and rebound pawls.

The cross-section of the feedway channel is an approximation of the section of the bullet, so that in feeding down the cartridges will be guided smoothly into the receiver. The forming of the channel is accomplished on a multiple-spindle machine which mills six magazine centers at once, although all spindles are independently controlled so that as fast as one magazine center is cut another may be slipped in place without affecting operations under the five other spindles.

The machine is illustrated in Fig. 129. The centers are already bored and sized before being brought to

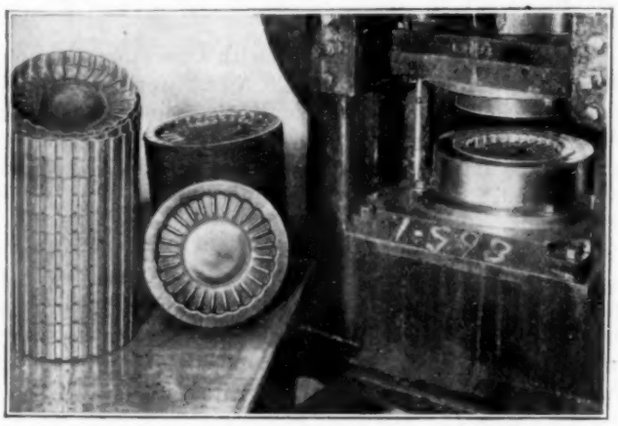


FIG. 130. DRAWING THE MAGAZINE PAN

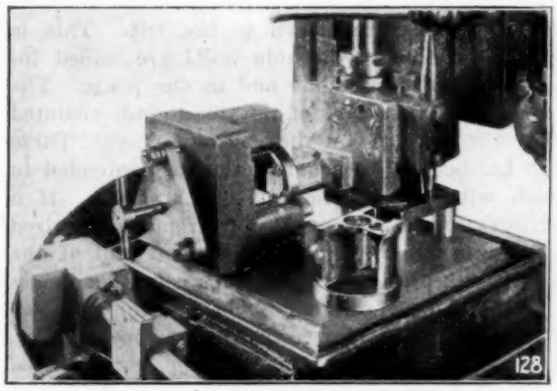
this machine. They are slipped on the machine spindle, the feed thrown in and the cut started and controlled automatically until the feedway has been milled out upon which the spindle stops and the grooved center is removed and replaced by another blank.

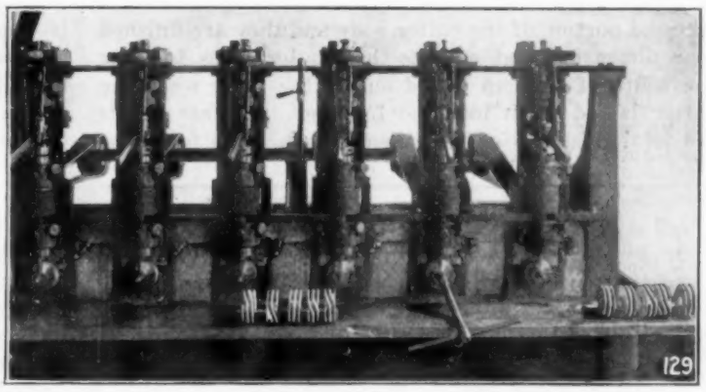
The cutter spindles are operated at a high rate of speed and the work is milled very rapidly. The horizontal spindle for carrying the blank is actuated by suitable worm gearing to rotate the work past the vertical cutter, and at the same time the work is fed axially to produce the cam-shaped portion of the slot by means of a master form or cam.

DRAWING THE PAN

In Fig. 130 the work of drawing the pan with its corrugated walls is illustrated as accomplished in a powerful Bliss press of the toggle type. The first operation press forms the work into a shallow pan with corrugated bottom and starts the forming of the side-wall corrugations as shown by the stack of work near the left side of the press. The work is drawn up to depth with side corrugations complete in the second operation in Fig. 130.

The retainer clips attached to the interior of the walls of the pan are shown in large numbers in the tray in front of the press in Fig. 131. These are





FIGS. 128 AND 129. UNUSUAL PROFILING AND MILLING OPERATIONS
Fig. 128—Interior profiling of locking piece. Fig. 129—Milling channels in magazine centers

blanked, formed and pierced to provide two triangular clinching points or riveting tongues by which they are later secured to the interior of the wall around the pan. The two openings for receiving and securing the clip points are shown clearly in the pan seen on the horn of the press. This engraving illustrates the riveting operation, which is accomplished very rapidly by slipping the retainer clips into place in the pan and striking one blow with the punch in the press.

The quantities in which the magazines are manufactured can be seen in Fig. 132, which shows the pans and centers assembled on the long benches.

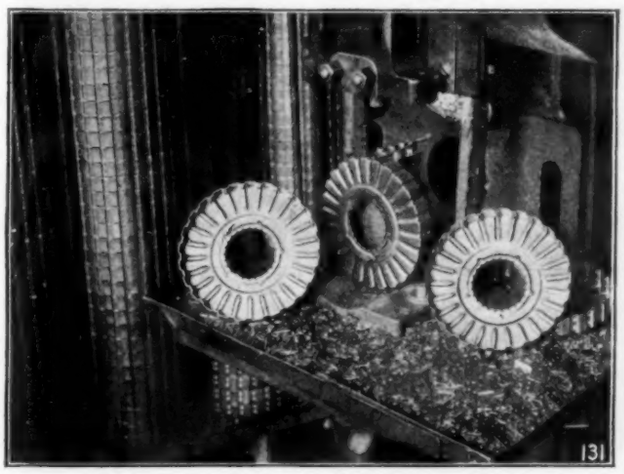
Two Unusual Milling Cuts

In Figs. 133 and 134 a method is illustrated for taking unusually awkward cuts which have to be milled in a forging known as the gear case. This part houses the main spring and the gear which meshes with the rack that forms part of the operating rod, the rack and the striker. This striker is carried by the top projecting lug of the rack, and the piston is screwed into the rack and held by an assembling spring. The gear casing is machined out from the top to form a pocket which incloses the gear for nearly its full diameter, and it therefore presents an interesting problem in manufacture for its interior at the bottom must be swept out to a radius a little larger than the outside diameter of the gear. There is a central opening through the side walls, but this does not allow any ordinary type of recessing tool to be applied. The character of the work can best be seen by referring to Fig. 133 where a partly finished case is shown in front of the milling fixture.

Milling of the greater portion of the chamber in this gear case is accomplished with a novel cutter application. The forging is held in a clamping fixture on the table of the milling machine, and its correct location assured by suitable supports and by side stops against which it is secured by a swinging clamp and screw at the front. The machine spindle is fitted with an attachment carrying a short arbor on which is secured a gear for driving the cutter, and the latter is rotated by direct action of the gear teeth which mesh into the teeth of the cutter itself. The cutter teeth are of special form to allow the gear teeth to drive it with smooth action and without contacting with the cutting edges and so injuring their faces. The driving pressure is taken at the backs of the cutter teeth and the backs of the gear teeth are relieved to special contour to provide sufficient clearance to prevent injury to the edges of the cutter teeth as the tooth curves roll apart.

The Cutter Used

The milling cutter is recessed in each face so that the ends of the teeth have considerable overhang beyond the body. A short stud is provided for supporting the cutter, and its ends are housed in a forked support extending downward from the attachment, as clearly shown by the engraving. It will be noted that the forked sides are bent inward to a close fit to the



FIGS. 131 AND 132. RIVETING AND ASSEMBLING MAGAZINES
Fig. 131—Riveting retainer clips on pans. Fig. 132—Assembling magazines

recessed portion of the cutter body and they are finished to a dimension that enables their outer faces to clear the width of the gap milled out in the work when the cutter is fed down into the forging. In other words the total thickness of the supporting bracket forks for the milling cutter is less than the width of the cutter teeth, hence the necessary clearance is obtained for the sides of the cutter carrier.

SEQUENCE OF OPERATIONS

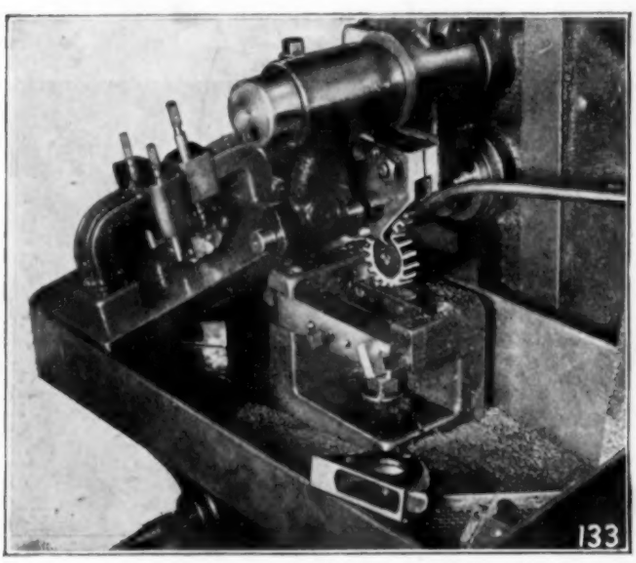
1. Rough-mill for operation 2.
2. Mill surface on top of taper, leaving 0.010 to finish later.
3. Spot, drill, ream and bur.
4. Mill front and rear end.
6. Profile inside shape to size, right side.
7. Profile inside shape.
8. Profile inside shape to size, left side.
9. Profile inside shape to size.
10. Mill form shape over locking slot.
11. Rough under side of radiator brace.
12. Rough locking face.
13. Straddle-mill bottom brace on both sides.
14. Drill and ream barrel hole and face rear end.
15. Bore face, ream casing hole, turn outside to size and tap radiator clearance hole (rough).
15½. Bore face, ream casing hole, turn outside to size and tap radiator clearance hole (finish).
16. Drill and ream piston hole and assembling hole.
17. Grind face.
18. Shave rack clearance.
19. Straddle-mill rear boss.
21. Profile radiator clearance hole.
22. Profile air-clearance cut, roughing cut.
23. Profile right and left corners of air space.
24. Finish profile air-clearance cut.
25. Profile sides to match receiver at rear end.
26. Profile rounded corners on bottom brace.
27. Butt mill corner, right and left, under sides of table.
28. Rough under side of radiator table, stopping at beginning of round corners.
29. Profile right and left corners on under side of radiator table.
30. Finish under side of radiator table.
31. File to fit radiator.
31½. Rough-polish platform.
32. Finish locking face.
33. Rough cut locking slot.
34. Finish locking slot.
35. Drill and ream locking-pin hole.
36. Mill locking-stop shoulder.
37. Profile top side of radiator table finish.
38. Profile sides of radiator table, cutting off position lugs on sides.
39. Profile under side of table.
40. File body of locking piece.
41. File under side of table.
42. Counterbore barrel seat.
43. File to fit receiver.
44. Disk-grind table to match receiver.
44½. Corner sides.
46. Harden.
47. Polish radiator casing locking piece (complete).
48. Bur corners and file to fit rear casing and screw on rear casing.

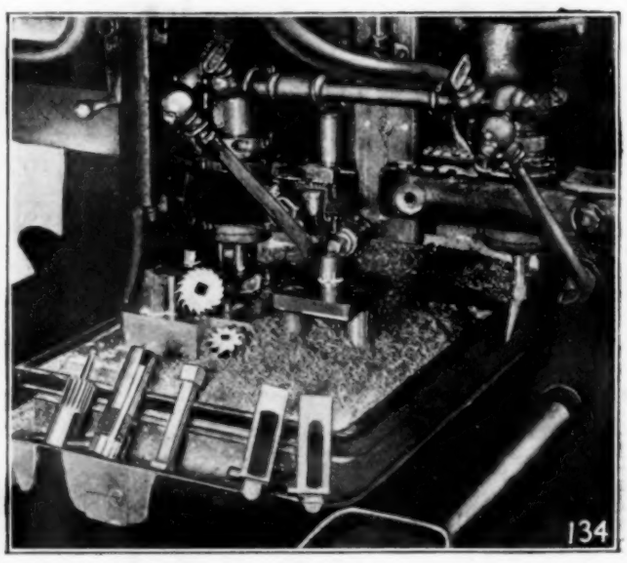
Following the milling of the gear casing the work is gaged by the fixture shown to the left. This is applied to determine if the side walls are milled internally to correct dimensions and in one plane. The test is carried out by means of the three plugs mounted in the upright brackets on the gaging fixture. These plugs are finished with shoulders that are intended to come flush with the top face of the brackets. If a piece of work should be slightly off from its required position in relation to the center line or wall of the forging the flush pins would show this condition immediately. The width of the cut is checked for accuracy by means of plug gages slipped in from the open end.

After this milling operation has been performed a second cut is taken on a profiling machine to sweep out the lower portion of the case and finish the corners without widening the chamber produced by the operation as described above. For this second cut a type of tool is employed which will be noted in Fig. 134.

The large opening at the left side of the gear case has been counterbored before work comes to the profiling machine for finish-milling the interior, and this opening through the side wall allows the profiling principle to be made use of; that is, with a cutter inside the work profiling movements with guide pin and form control may be utilized to control the action of a cutter operating at a point entirely inclosed and obscured from observation.

The cutter lying on the face of the fixture on the profiling machine is convex and of the radius desired inside the work. Its central hole is square instead of round, and its faces are smooth so that it cuts only on the circumference. The square hole is to allow it to be driven by a shank of similar section formed on the lower end of the cutter arbor. The cutter is slipped into the chamber as already milled and the squared arbor fed down by the spindle to enter the similar hole in the cutter. This gives the driving connection, and the work from now on consists in operating the machine table as for any regular job of profiling, the operator controlling the movements by the guide pin in the form plate at the right. The operation is rapidly performed, as only a limited amount of material remains to be swept out by this second cutter.





FIGS. 133 AND 134. MILLING AND PROFILING OPERATIONS
Fig. 133—Sweep milling the gear case. Fig. 134—Profiling the gear case

Elliptic Gears Built Up From Segments

By ROBERT MAWSON

A brief description of the tools and methods used in machining a part that is a little out of the ordinary routine and for the purpose of stimulating the ideas of mechanics who may be called upon to produce similar parts.

THE movement of the printing bed of the Whitlock "pony" printing press is accomplished by elliptic gearing for the purpose of securing an even, rapid traverse while the paper is under impression, and a smooth reversal at the end of the stroke with the least possible shock or jar. The gears used for this purpose are built up from segments which have been cut separately, and are then bolted to a flange or web.

The jig for drilling this web is shown in Fig. 1 with the web casting attached. A stud on the under side of this jig fits into the bore of the web, which has previously been bored and faced, and the contour of the web is brought to match that of the jig. In this position any convenient hole is drilled, and a plug is passed through both jig and web to definitely establish their relation while the rest of the holes are drilled.

The segments have corresponding jigs to locate the holes necessary to bolt them to the web. One of these jigs is shown in Fig. 2. It will be noticed that the segment is located with reference to the drill bushings by two hardened-steel tooth profiles *A* fitting into opposite end tooth spaces of the segment. The work is held in contact with these locating blocks by the thumbscrew *B*, while two hook bolts *C* hold it against the pressure of the drill. The surfaces *D* are ground to a true plane extending slightly above the work, and it is upon these surfaces that the jig rests, as shown at *E*, during the operation of drilling.

An assembling stand is shown in Fig. 3, which can be set at any convenient angle to enable the operator to handle the job most efficiently. The tilting baseplate has two fixed studs located at the proper center distance, upon which the flanges, or webs, are placed and mating segments bolted to each of them. These two segments

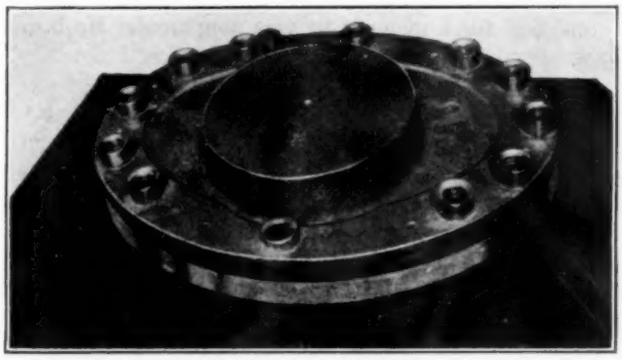
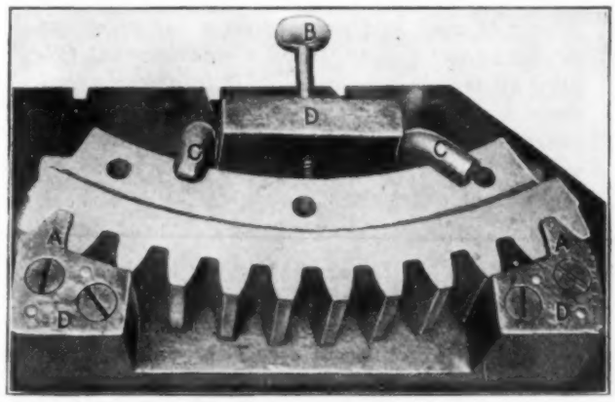


FIG. 1. JIG FOR DRILLING WEB OF ELLIPTIC GEARS



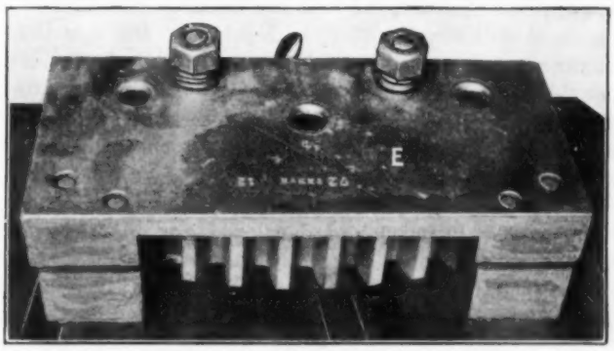


FIG. 2. JIG FOR DRILLING ELLIPTIC-GEAR SEGMENT

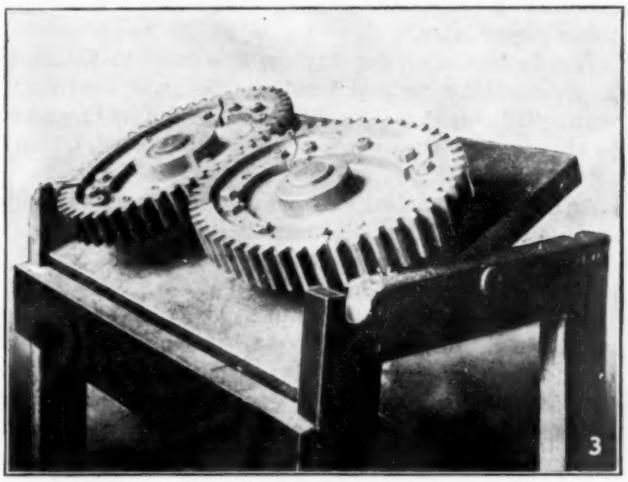


FIG. 3. ASSEMBLING STAND FOR ELLIPTIC GEARS

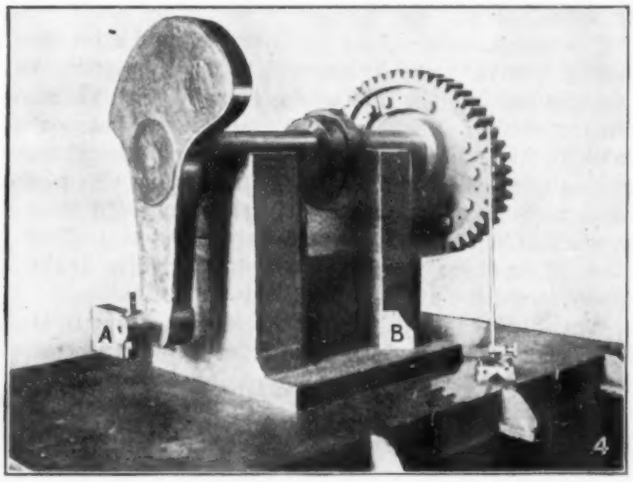


FIG. 4. LOCATING THE KEYWAY IN THE HUB

then receive such slight adjustment as may be necessary, the high spots are filed and the segments made to work smoothly together. Similar treatment follows with each additional segment until the completed gears may be rotated without appreciable backlash or binding.

The accurate relation of every part of a printing press is absolutely essential, and to assure this the location of the keyway in these gears is determined after the gears are finished. A crankshaft and crank are mounted in the fixture shown in Fig. 4 and the crankpin brought to bear against the block *A*. The gear is then put in place on the outer end of the shaft in which the keyway is already cut.

A gage (shown standing on the base of the fixture at *B*), which is made in the form of a gear-tooth profile and has a center line drawn across the back, is then placed in the tooth space at the junction point of two certain segments and the line on the gage brought to coincide with the scriber of a height gage which has been set to the exact center height of the shaft. The position of the keyway is then scribed in the hub of the gear in the usual manner.

Inventing as a Business

BY JAMES LESLIE LANE

Inventing does not consist only in "getting the wheels to run" and forwarding a list of claims to the Patent Office. Many a machine that fulfilled all that was expected of it in a mechanical sense never had a chance to repay the man who conceived it because the field of its usefulness was too limited. The tyro is here given advice by the man of experience.

"WELL, Mr. Lake, what do you think of them?" As Robert spoke he leaned across the table toward his companion and studied the prints before him with no little pride. They had been worked out with the greatest attention to detail and were well drawn, for whatever he laid his hand to Robert had a habit of doing well. If it had not been for this thoroughness and a considerable natural aptitude for mechanics he would not have been at 23 the head designer of one of Chicago's largest special machinery builders and spoken of among his associates as a chap who would undoubtedly be heard from later.

Although he already had several minor inventions to his credit, which he had developed for his firm and which had all proved unusually successful, this was his first venture into the inventive field as a free lance. The sheets were the working drawings of a filler wrapping machine, the idea of which he had hit upon several months before while doing some consulting work for an outside firm.

The field had seemed a promising one, and after consulting a banker who had agreed to finance matters he had plunged into the task of designing it with his customary energy, doing the work at home evenings on a table in his room. The idea called for a continuous wrapping mechanism to replace the slow piece-by-piece hand method, and involved several complicated movements that had taxed his ingenuity to the utmost. However, after three months of persistent effort he had finally solved the problem to his satisfaction.

When it was finished Robert took the drawings to Mr. Lake for his friendly inspection before handing them to the banker. Several years before the older man had set up in business for himself as a consulting and developing engineer and had built up an extensive practice in the industrial field. He had known Robert since he was a boy and had more than once aided him in difficult problems when he was appealed to, for not only did he admire the boy's energy and clean-cut ways, but, being a free lance himself, he sympathized with his ambitions.

For several moments he sat studying the prints with a speculative eye. Then tilting back in his chair he removed his glasses and wiped them carefully, an unconscious habit of his when he was trying to settle some abstruse point.

"Before answering your question Robert," he said at length, "I want to ask one. Is this machine the only one you have in mind? Did you work it out because you thought there would be money in it, or was it because you wanted to get into that line of work—to take up the development of new ideas as a business?"

Robert had been expecting something entirely different and for a moment he was nonplused. He began to wonder what the other was driving at.

THE TRUE REASON

'It was mainly the latter reason," he replied. "Of course I did expect to make a little money at it, but more than that I hoped it would prove a stepping stone to something else. It's the only kind of work I would care to spend my life at, but getting started is a difficult job. Unless a fellow has something to show, no one is willing to give him a chance. And if he has never had a chance how is he going to convince others of his ability? That is what I hoped it would do—prove an entering wedge that would get me a hearing on something bigger later."

Mr. Lake smiled, for having once been in the same predicament he realized what the boy was confronted with. "I thought so," he replied. "And now I'm ready to answer your question."

"You like it?"

"From a mechanical standpoint, yes," was the reply. "I'd go on with it by all means."

"And you think it will prove a success?"

The older man smiled.

"Well," he laughed, "that depends a great deal on what you mean by success. As a mechanical proposition I have no doubt it will do all you claim for it. The idea is a good one and the design excellent. Still, from a financial point of view, I hardly think it will prove a gold mine. Indeed I should say that if you broke even on it you would be lucky."

"But why?" Robert demanded, somewhat crestfallen. "It will cut labor cost in half and the call for it is there."

Lake nodded.

"I know," he said, "but a great many things besides mechanical perfection determine the money possibilities of an invention. Development of special machinery is a business—a profession in itself. It has to be studied just like story writing or architecture if an engineer is to be successful at it. He must learn not only design, but what to work at and what to let alone. If he doesn't he will be wasting about half of his time on nonessentials.

"The best illustration of what I mean," Mr. Lake continued, "is an incident that occurred early in my own career. Shortly after I had hung out my shingle a chap came along with some rough sketches of a machine for sewing on buttons. He was a tailor by trade, and having conceived the notion that he could monopolize the suit-making industry with it he brought the idea to me to be worked out. If I had been older at the game I could have told him offhand what I came to realize only after the machine had been built—that the call for it was more imagined than real!

Cost Percentages

"What we both failed to see was that since the cost of sewing on buttons was an infinitesimal item compared with the manufacturing price of the whole suit a saving of labor on this operation alone would not give the manufacturer any appreciable advantage over his competitors."

Robert saw the point.

"You mean then that if such a machine is to be valuable it must effect a saving on some major operation?"

Lake nodded.

"Exactly," he replied. "If its cost is to be justified the saving must be a real one. In other words the net expense a manufacturer is put to in turning out a finished article must be reduced, allowing him a larger profit than before.

"A good example of this is the manufacture of small nuts, studs and capscrews. Many years ago, although the automobile industry had not created the enormous demand for them that we see today, the annual number required ran into the millions. The process of making them was slow. Each had to be turned out on a small lathe by hand, the various operations being separate. The result was that the money expended on labor per piece was high, even though such labor was then comparatively cheap.

"The call for the product was real and the manufacturer did not need to spend a great deal in advertising. Usually it was just enough to keep his name before the public, since one brand was about as good as another. His main expense was for labor, material and overhead. When it came to determining the actual cost of each part it was generally found that the labor cost exceeded that of both material and overhead combined.

"Here then was a real demand for improved production machinery, and when the development of the automatic screw machine placed such an instrument in his reach the manufacturer was not slow in adopting it. The reasons for doing so were obvious. It secured to him greater profit, due to decreased labor cost, and better still it gave him an advantage over his neighbors, since he was now able to undersell them and increase his sales—a tremendous asset where competition was so keen.

"Added to this was the fear that if he did not take advantage of the opportunity and keep abreast of the times other and more progressive competitors would, and undersell and outdistance him."

Robert nodded his appreciation.

"Practically forced into it, eh?"

"Precisely," said Mr. Lake. "And since he could well afford to do it the inventor profited accordingly. The main thing, from his point of view, was that there were a great many such manufacturers. The cost of drawings, patterns, experimental work, etc., made the expense of building the first automatics so high that they barely repaid him. Where he made his profit was in duplicating them later for other firms after the machines had been standardized.

"There are probably a dozen other good examples," he continued, "but this illustration is sufficient to enable us to lay down certain conditions that must exist if the inventor is to receive any great return for his work. The first is that the labor per piece expended on the product must be considerable; second, the demand for the article must be wide, and third, the number of manufacturers engaged in producing it must be large."

"That, you think, is the reason my machine is not likely to prove a success?"

Condition of the Sales Field

"Yes, it's one reason," admitted Lake, "but there are others. To begin with the conditions in the field are entirely different from those in the one just referred to. There the demand for the article was established; here it is not. Where the screw manufacturer expended a great deal on labor and little on advertising, the people you propose to deal with find things exactly the opposite. The demand for their product, since there are other things on the market that serve the same purpose, has to be created. Their manufacturing methods are inexpensive now, and for every dollar they spend in making their product they spend a hundred in advertising it.

"In the nut and screw industry competition lay in the matter of production; here it is competition in advertising. And this burden so far overtops the other that even if you could cut their manufacturing cost in half you would not give them any considerable advantage over others in the field. As it is your machine only effects a saving at one stage of the work.

"Now if it were the advertising burden you were cutting in half it would be a different story. You get the idea, don't you?"

"I think so," said Robert. "And I see now why the returns probably would not pay for the cost of patterns and drawings. It's because there are only two or three manufacturers who could use the machine, even if it proved a success. What I don't see though is why you advise going on with it after what you've told me."

"Because," replied Lake, "you are anxious to get into the game of developing as a life business. You must

make a start somewhere; must, as you remarked a moment ago, have some tangible evidence of your ability to show people. This piece of work will do that for you. It will bring you in touch with men and get you a chance later at something really worth while. You will have to learn all the ins and outs of the game just as I did, and there is nothing better than a financial failure to teach a man that."

Robert folded the prints and rose to go, but Lake restrained him.

"A moment more," he said. "While we are on the subject we might as well finish it, Robert. You expect to protect the idea, don't you?"

"Yes, I did intend to," his visitor admitted. "However, after what you've told me, I don't know whether to or not. It seems like a waste of money."

"Not if it teaches you anything," was the rejoinder. "And I'm sure it will. A clear conception of how to set about protecting an idea is as important as knowing how to handle the mechanical end of it.

"I have always thought," he went on, "that this was one weakness of the ordinary run of inventors. They know how to originate but not how to secure their rights. The majority imagine, along with the general public, that all there is to be done in such a case is to go to a good lawyer, have him draw up a lengthy petition with an imposing list of claims and forward it to the Patent Office."

"Isn't it sufficient if the lawyer consulted is a good one and knows how to draw up his claims? If he makes them broad so that the idea is fully covered?"

Lake shook his head.

"Far from it, Robert, except where the idea is simplicity itself and there is no other practical way of accomplishing the same end. An engineer that is on to his job never contents himself with taking out a patent. He takes out several."

"Why more than one?"

"Because," replied the older man, "practically every end can be attained in various ways. If you are to reap the advantage that comes from being able to produce a thing more cheaply than a competitor you must protect all the different ways by which this might be achieved."

"It's like keeping burglars out of a house," he concluded. "Locking the front door is useless if the windows and rear door are left open. He would get in anyway. The thing to do is to bar them all."

Two Tools for Heavy Lathe Work

By Vilas H. Jackson

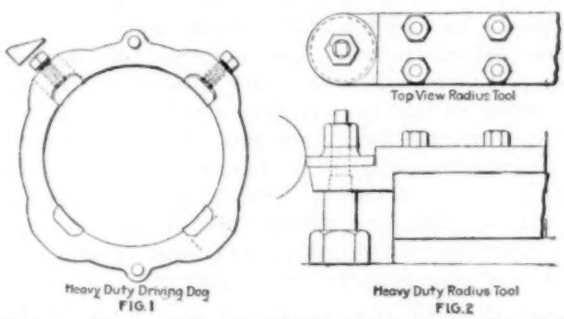
Much of the heavy lathe work that falls to the lot of the machine shop handling marine repairs consists of propeller and thrust shafts, rudder posts and connecting-rods, the forgings for which, of wrought iron or machine steel, are very rough and considerably over size, there being as much as 3 in. of stock to be removed in places, and the contour of the forging at times resembling a relief map of the Rocky Mountains.

Fig. 1 is a driving dog, the frame of which is a steel casting having tool-steel gripping pieces with serrated bearing surfaces inserted in the frame to do the driving. Brackets for the driving studs are cast integral with the frame, and there are two holes in the latter for bolting the dog to the faceplate when it is desired to swing up the work in the steadyrest.

In turning shoulders in these parts it is necessary to leave generous fillets, and to accomplish this efficiently I designed the filleting tool shown in Fig. 2.

The holder is made to fit over the toolholding studs with which these heavy-duty lathes are usually provided and is made of machine steel. The cutter is a disk of high-speed steel with its upper surface ground concave and with one quadrant serrated or toothed in order to break up the chips on the roughing cut.

This disk is mounted on the holder by a stud which



FIGS. 1 AND 2. HEAVY DRIVING DOG AND TOOL FOR LARGE FILLETS

extends through the latter and is fitted with a nut on its lower end to bear on the surface of the cross-slide and thus furnish a point of support directly under the cut. A nut on top of the stud holds the disk in whatever position required. The serrated quadrant of the disk is presented to the work until the surplus stock is removed, and then by loosening the binding nut another section of the tool is brought into service for finishing.

By this means one quarter of the tool may be kept sharp indefinitely and used only for the final scraping cut each time.

Top Rake for Threading Tools

By Toni Fazio

Here is a little suggestion in cutting V-threads, especially if the pitch is coarse or on long screws where there is a tendency to spring.

Instead of grinding the tool to an angle of 60 deg. a better way is to grind away the right side so that it will do no cutting, and to grind a top rake on the remaining lip, virtually making it a side-cutting tool. Then set the compound rest on the lathe to 30 deg. and instead of feeding in with the cross-feed screw use the compound screw so as to follow one angle of the V.

At the end of each cut back out with the cross-feed and for the next cut, return the cross-feed to the same position as indicated by the micrometer dial (which must be set on the first cut) and advance the compound screw for the feed.

The idea is that the V-shaped tool has a greater cutting surface than the side-cutting tool, thus causing a greater strain on the work. The rake on the side-cutting tool cuts the metal off more readily. For cutting left-hand screws the tool would have to be ground the opposite way and the compound rest set to the left instead of to the right.

Special Graduating Machines

By J. V. HUNTER
Western Editor *American Machinist*

Machine-tool manufacturers who have made use of machines for graduating the dials and scales on their machine parts have usually built them because there has never been sufficient market to justify their manufacture. One machine-tool manufacturer has built two machines for this purpose which are here described.

THE machines described in this article were designed by the Oakley Machine Tool Co., Cincinnati, Ohio, for graduating circular and flat parts of its universal grinding machines.

The machine built for graduating circular parts is illustrated in Fig. 1, and the part to be graduated is shown at *A* with the graduations at *B*. The tool *C* used for marking the graduations operates with an up-and-down stroke and is actuated by a ratchet cam *D*, Fig. 2, having four short prongs and one long one, so that every fifth stroke gives a long line for division mark. The part to be graduated is mounted on an arbor *E* supported by the sleeve *F* in which it revolves.

The dividing movement used on this machine is shown at *G*, and will be fully decribed later in conjunction with the same type of movement used on another machine. Suffice to say that this movement gives one-quarter turn to the shaft *H* to each revolution of the handwheel *J*. When the shaft *H* receives this 90-deg. movement it operates through the worm drive at *I* to give a 1-deg. movement to the arbor *E*.

When movement of the work from one division to another is completed, the ratchet cam operates on the graduating tool to lift and make the required mark, whereupon the tool again drops down into its rest position while the next division is being made.

The drive for this work is all done by means of the handwheel *J* and the operator must give this handwheel one complete turn for each graduation mark made.

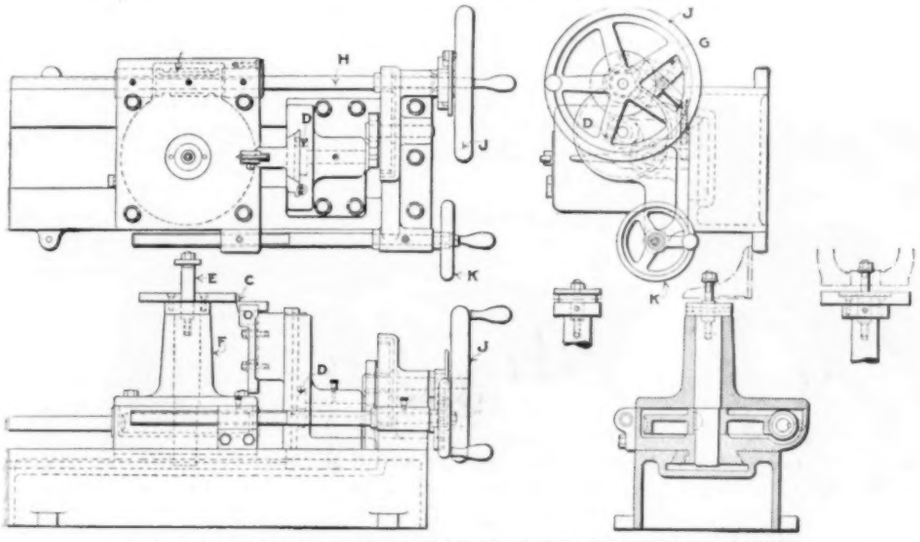


FIG. 2. DRAWING OF CIRCULAR-DIAL GRADUATING MACHINE

It will be seen that the sleeve *F* which carries the arbor is mounted on sliding ways on the base of the machine; this provides for adjustment within wide limits so that great variations are permissible in the sizes of parts which may thus be graduated. This adjustment, which also brings the work into contact with the cutting tool *C*, is done by means of the small handwheel *K*. When this sleeve is moved the worm *I* is at the same time carried along the shaft *H* upon which it slides.

After the graduating has been completed the part is

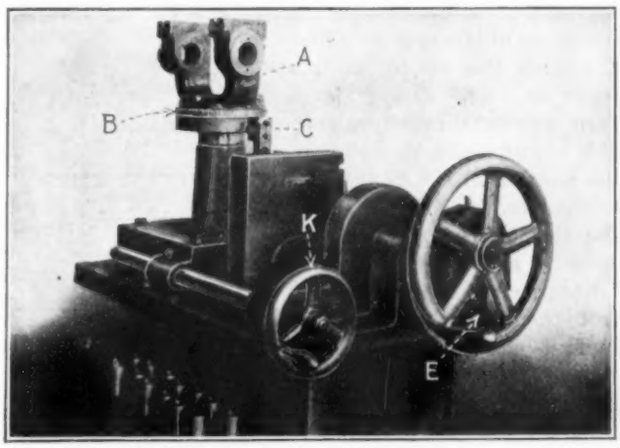


FIG. 1. GRADUATING MACHINE FOR CIRCULAR DIALS

taken to the machine shown in Fig. 3, where the numerals are pressed into the surface above the corresponding graduations. In this illustration the graduated part is again shown at *A* with the graduations showing at *B*. The part which does the marking of the numerals is the ring *C* which carries small dies *D* projecting slightly from the ring and bearing the proper numbers in sequence. These are removable so they may be replaced in case of damage. It will be seen that the part *A* is mounted on a revolving arbor *E*, and when it has been placed in the proper position with regard to the numeral-marking device the dies *D* are forced into contact with it by means of the handwheel at the left.

The operation from this point is very simple, consisting merely in turning the handwheel *G* at the right, which operates through gearing to turn the arbor *E* and the ring *C* with uniform motion, and thus roll in the numerals above the corresponding graduation marks.

It will be well at this point to consider the indexing movement before taking up the description of the sec-

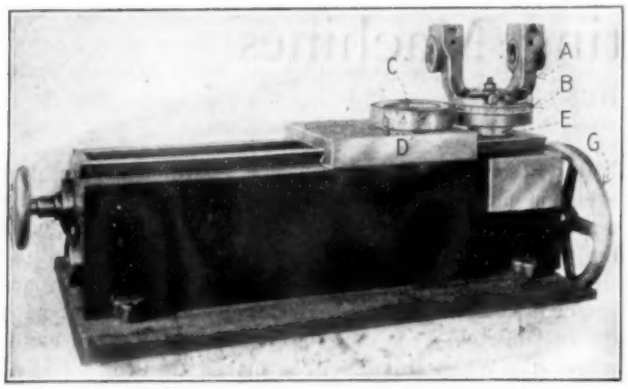


FIG. 3. DEVICE FOR ROLLING IN NUMERALS

ond graduating machine. At *A*, Fig. 4, is a sort of cam with four slots extending radially and spaced 90 deg. apart. Motion is imparted to this cam or sprocket by means of the revolving disk *C*, which has on its back a roller *D*. The disk *C* is in turn driven through a suitable set of gears by means of the handwheel *E*. As the disk *C* revolves, the roller *D* enters the slot on the right of the sprocket at *F*. When the disk *C* has revolved through 90 deg. from the point where the roller *D* first entered the sprocket groove it has revolved the sprocket 90 deg., so that the groove *F* will be standing in a vertical position, at which point the roller leaves it and continues its circular travel with the disk *C* through 270 deg. before it again enters into the next groove, which is then at the position *F*. Fig. 5 shows a machine for marking the scale graduations on the swiveling table of a grinding machine, and the indexing sprocket is shown at *A*.

The part to be graduated is the table *B* which receives its graduations on the portion *C*. The graduating tool is at *D*. It may be seen that by means of the slots *E* the tool may be adjusted in all directions.

Motion is imparted to the graduating mechanism of this machine by the handwheel *F*. One of the teeth on the ratchet cam shown at *C* in Fig. 6 strikes the lug *E* on the slide which carries the graduating tool and pushes it forward the required distance. As the slide moves forward the tooth slips under the lug which it has been working against and the springs *D* return the marking tool to its original position. Like the ratchet cam on the previously mentioned graduating device one of the teeth is longer than the others.

In order that the graduation shall start right on the table it is set with its center line under the graduating tool. By releasing the stop pin *G* and turning the handwheel the pointer *H* is brought to zero without disturbing the table setting. Replacing the stop pin connects the pointer with the graduating mechanism so that the operator can tell at a glance which line he is graduating.

As it might be desired to use this graduating machine for smaller pieces than that shown a means is provided for shifting the table by a screw shown at *I*.

The arbor on which the work is mounted is shown at *O* and the table upon which the part rests at *J*. A key at *K* fits a slot in the work and keeps it from turning on the arbor. The screw and washer *L* and *M* are for clamping the work down into a secure position.

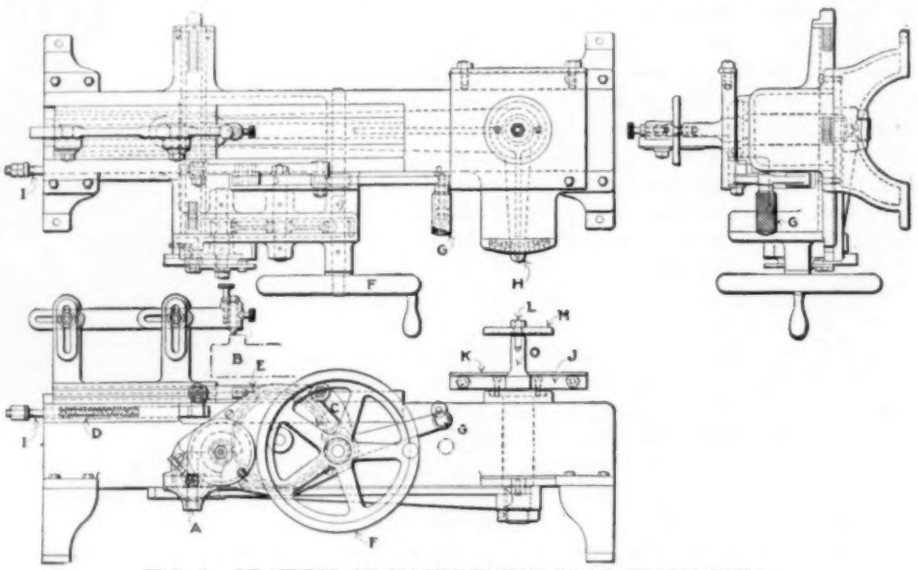


FIG. 6. DRAWING OF MACHINE FOR FLAT GRADUATING

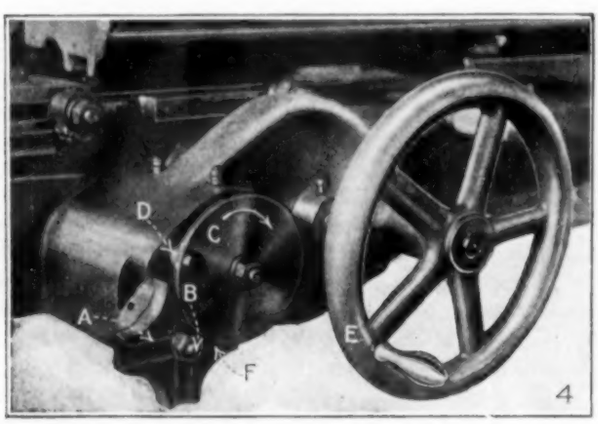


FIG. 4. THE INDEXING MECHANISM

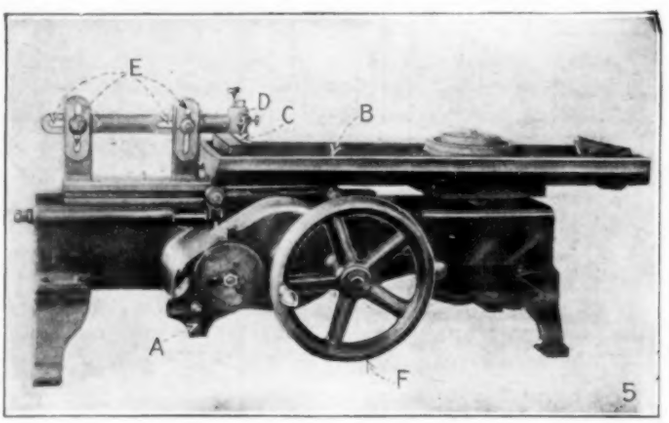


FIG. 5. MACHINE FOR FLAT GRADUATING

"Pre-Existing Condition" of the Workman and Its Relation to Compensation for Injury

By CHESLA C. SHERLOCK

The physical condition of a workman at the time of an injury is usually a factor in deciding compensation cases. Many courts hold that an abnormal condition resulting from a claimant's wilful or habitual neglect to observe the common rules of health should act as a bar to recovery, while others contend that an accident should be considered apart from such physical condition of the employee, even though said condition may be contributory to the accident or tend to hasten the death of the injured person.

COMPENSATION is payable under the workmen's compensation acts for injuries resulting from accidents "arising out of and in the course of" the workman's employment. Death is an "injury" so far as the statutes are concerned, and a man killed while at work is deemed to have received a compensable injury so that his dependents may recover from the employer.

Where the injury or death is caused entirely by the accident received while at work there is slight difficulty in determining the law in the matter and in applying the relief afforded, but it is different when it can be shown that the workman was suffering from some condition prior to the accident, which really caused the death.

If a workman having heart disease, for instance, is killed by shock caused by a heavy box falling behind him while at work, is he entitled to compensation? Has he suffered an injury "arising out of and in the course of" his employment?

Take another instance, that of a 65-year-old workman who for years has been employed at moving heavy cases that were too heavy for him and who eventually suffers a cardiac breakdown. It is admitted that no sudden strain or overexertion took place; he just naturally came to the "end of his string" because his outraged physical being was unable to serve him further. Was this man entitled to compensation?

Or, again, suppose a workman suffering from an occupational disease so that it is only a question of time until he will be incapacitated from work. He has been warned to take care of his health, and he leaves his employment to try to regain that which he had lost. His employer is in need of labor and offers him higher wages if he will come back and work a few weeks. The workman goes back and receives an injury which aggravates his disease so that the latter kills him. Is this man entitled to compensation?

These are only a few of the many problems that are constantly coming up in regard to compensable injuries under the statutes.

It is a fundamental proposition underlying the compensation laws that if a man is injured while at work, having contributed something to society's wealth, it is up to society, through the employer, to compensate him for the injury suffered. This cost of human wreckage is to be considered as a part of the cost of production and to be borne by society as other costs of production are borne. But this broad and generous principle is restricted by the statutes in some particulars. Diseases are not to be considered as compensable unless they are the result of an accident "arising out of and in the course of" the workman's employment. Occupational diseases are not considered compensable, except in Massachusetts and those other states specifically mentioning the subject in the statute, because an occupational disease is not an "accident" as that word is used in the statutes. Not only that, but a workman cannot recover compensation for something which is entirely premeditated on his part, as the statutes do not allow recovery if the accident is caused by the workman's own "serious and wilful misconduct."

In view of all of these exceptions to the general principle underlying the compensation acts, it is altogether out of reason for employers to contend that the preëxisting condition of a workman should be taken into account, and if it is found that the accident would not have killed him or injured him if he had been in full possession of his health and vigor then no compensation should be paid.

Why should the employer be called upon to bear the burden of something which he is not rightfully supposed to bear? Why should industry be taxed with such a load when it would not have been taxed if the trivial accident had not taken place? Recovery is predicated upon injury by accident due to the employment, and not to something that the workman has contracted outside the employment and having no connection with it. These are considerations which employers are urging almost daily, and they cannot be taken lightly, as they go to the very foundation of compensation practice and theory.

What does the term "preëxisting condition," as applied to compensation cases, mean? To treat the matter roughly it means that the workman is suffering from some disease or impairment which has greatly undermined his health so that he is no longer an able-bodied person and is susceptible to injury or death where a man in good health would not be in serious danger.

Often heart disease is a preëxisting condition, or it might be venereal disease, hernia, varicocele, blood poison, etc.

Our compensation acts are founded largely upon the compensation act of Great Britain, and as the British courts were brought to a consideration of these questions long before our courts, we have naturally looked first to their decisions to see how they treated the matter.

One of the first expressions to be found upon the subject of preëxisting condition was handed down in England in 1908 in the case of Ismay versus William-

son, 1 B. W. C. C., 232. Said the court: "Compensation is not necessarily barred merely because the workman's impaired physical condition at the time rendered him more susceptible to injury than a normally healthy man."

But this should not be taken to mean that the door is closed to the plea of preëxisting condition. The courts have said again and again that compensation cases cannot be determined by established precedents of decided cases, but in order that they may be tried in a spirit of helpfulness each case must be determined by the facts immediately surrounding it, and not in view of some other decision or opinion handed down.

And the English court, while ordinarily precedent-bound in common-law actions, recognized this as good law so far as compensation matters were concerned. In the case of Hensey versus White, 1 Q. B., 481, we find the court saying: "No compensation is recoverable in respect to an incapacity primarily caused by a disease or the impaired physical condition of the workman at a time when he is doing his ordinary work in the ordinary way."

Absence of Proof

Also in Wood versus Wilson, 6 B. W. C. C., 750, the court said: "There can be no compensation in the abscence of proof that the death resulted from a disease which was caused by the accident."

In Coe versus Fife Coal Co., decided in 1909, the court said: "And no compensation is recoverable for incapacity caused by cardiac breakdown which was not due to any sudden strain, but was the natural result of the workman continuing to do work which was too heavy for him."

With this slight background of English decisions in mind we can proceed to consider American cases with a clearer understanding.

The Iowa Industrial Commissioner has said: "Where a claimant under the law was at the time of accidental injury capable of performing the labor of an able-bodied man preëexisting conditions are not successfully plead in bar of compensation."

Predisposing Physical Condition

In Hartz versus Hartford Faience Co., 90 Conn., 539, and 97 Atl., 1020, it was held that "whatever predisposing physical condition may exist, if the employment is the immediate occasion for the injury it arises out of the employment because it develops within it. When the exertion of the employment acts upon the weakened condition of the body of the employee or upon an employee predisposed to suffer injury in such a way that a personal injury results, the injury must be said to arise out of the employment. An employee may be suffering from heart disease, aneurism, hernia or any other ailment, and the exertion of the employment may develop his condition in such a manner that it becomes a personal injury. The employee is then entitled to recover for all the consequences attributable to the injury."

In re Brightman, 220 Mass., 17, it was held that "where a cook on a lighter overexerted himself while removing his effects from the sinking ship and died soon after of heart disease hastened by such overexertion the accident was the cause of his death, since any act which would have been reasonable for anyone to do when leaving a sinking ship, which was his temporary home, was within the scope of his employment."

In a New York case it was held that "even though a diseased condition of a workman's veins existed before the accident, compensation may be awarded if the injury hastens to a fatal close the disease with which he was afflicted." In another case decided by the New York commission it was held that "though a workman had a cancer prior to the accident it was undeveloped, and he had been in good health and had passed an insurance examination shortly before, and the medical testimony was that such a cancer might have continued for a long time without causing illness, the workman having died very shortly after the accident from hemorrhage due to the cancer, it was held the accident increased the virulence of the cancer and caused death to occur sooner than it would otherwise have done, and therefore the case was compensable."

In Wisconsin the commission held that "where a workman in a weakened condition on account of a previous operation was struck in the side by a crane hook, the blow not being sufficient in itself to cause the empyema which followed, but exasperated or hastening the disease, the blow was the proximate cause of the injury."

An English Case

In the English courts a case came up regarding the preëxisting condition of a workman due to the excessive use of alcohol over a long period. It was shown that the workman's brain, liver and stomach were in a diseased condition due to this use of alcohol. He received a slight injury, but because of the condition of these organs he died. He would not have died had he been free from the effects of liquor, for the injury was sufficient only to incapacitate a normal man for a short time. The court, however, held that if the accident caused death to occur sooner than it otherwise would it was a compensable case.

In another English case a unique proposition was decided. A workman received a slight injury and was temporarily unable to work. Compensation was being paid him, and during this period a cardiac infection supervened, which incapacitated him for further service. The question was, Is this to be considered a part of the original accident? The court so held and awarded the workman additional compensation.

In the case of Milwaukee versus Industrial Commission, 160 Wis., 238, it was expressly held that "a blow on the head, which in all probability would have caused no serious injury to a normally healthy man but which caused the death of the workman who was suffering from an advanced stage of arterial sclerosis, may be held to be an accident."

In an English case it was held that compensation is recoverable for incapacity due to accident, although there might also have been incapacity had there been no accident. In another case it was said: "The mere circumstance that a particular man, in doing work arising out of and in the course of his employment, meets with an accident which a perfectly healthy man would not have met with, is no answer at all." And, again, it was held that the consequences of the injury were aggravated by the workman's physical condition

at the time the injury was received does not prevent a recovery of compensation.

It has been urged if the courts and commissions hold that preëxisting condition of a workman is not to be taken into consideration in computing compensation, that it will react to the injury of the workman himself; that employers will refuse to employ workmen who are not in normal health in the future, and that as soon as a workman reaches a condition where a slight accident or injury will incapacitate him or cause death, due to this existing condition of his physical being, employers will discharge him. It is urged that this would do more harm to society than to recognize the fact that preëxisting condition is not properly chargeable to the employment and that some allowance should be made because of it.

But the courts are not influenced by this reasoning. The Iowa Industrial Commissioner has said that he has too much confidence in the good faith of employers to believe that they will break faith with the compensation service by following any such course. And it has been pointed out elsewhere that should such condition ever arise in our industrial life, as where workmen were regularly examined and turned away when they developed diseases or disorders, that some sort of legislation would be devised to take care of these unfortunates.

Employers have missed the spirit of the statutes when they resist these cases. Preëxisting condition should not receive any more consideration where the workman is apparently able bodied and able to do the work of a normal healthy man than the fact that a workman was ill at some time in his life or was incapacitated in any other manner.

If a man can do his work as well as he could if in normal health, and something happens arising out of and in the course of his work which robs him of his life or his health even though a little sooner than might have been the case had he been in good health, he is, in the eye of the law, entitled to the full benefits of the compensation statute.

This is the spirit of the decisions everywhere. I do not think a proposition has been more universally argued and agreed upon by the courts than the question of preëxisting condition. These cases should not, however, be confused with those where a workman in poor health is incapacitated while doing his ordinary work in the ordinary way and no accident takes place. Such cases are not compensable.

Squaring the Ends of Shafts in a Special Fixture

BY CHARLES K. SALISBURY

We had about 100,000 ends to square on propeller and axle shafts used in military trucks. The shafts were of chrome-vanadium steel and heat-treated before machining, which made it difficult to obtain accurate work, as the material varied considerably in hardness. The limits were close, considering the nature of the material, and to prevent danger of spoiling the shafts it was found necessary to mill the squares about 0.0015 in. over size and later bring them within the required limits by hand finishing.

The method used for a considerable time was to mill one face at a time with a 2½-in. plain milling cutter, using an accurate dividing head for indexing, one No. 2 and several No. 1 Kearney & Trecker milling machines being used.

While this method gave good results, there came a time when it was necessary to increase production, and as milling machines could not be obtained, the attachment here described was designed.

As the No. 2 machine was intended to mill two shafts

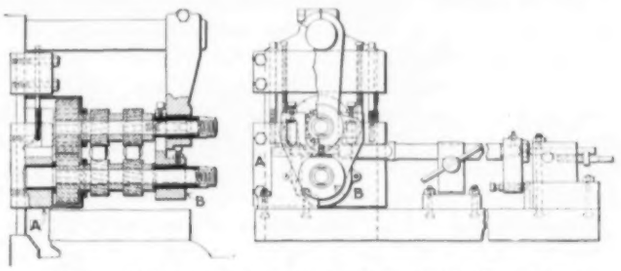
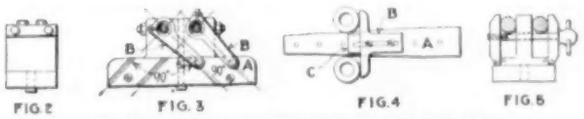


FIG. 1. FIXTURE FOR SQUARING ENDS OF SHAFT

at one time, arbors, cutters and collars of ample size were provided to reduce springing to lowest point. The No. 1 machines were intended to mill a single shaft, but it was desirable that the cutters, driving gear, etc., be interchangeable between the different machines, thus 1¼-in. arbors with 3 x 1½-in. spiral flute cutters of high-speed steel were used on all machines.

The No. 2 machine attachment for two shafts developed many difficulties in operation that did not show up with the single-shaft attachment, and for this reason the double attachment is the one shown and described.

The attachments for milling single shafts were of



FIGS. 2 TO 5. DETAILS OF FIXTURE

Fig. 2—The tailstock. Fig. 3—The headstock. Fig. 4—Setting gage. Fig. 5—Supporting vise for center of shafts

identical design, with the exception that the head and tail stocks carried single centers.

Fig. 1 shows the fixture assembled. The second cutter arbor was located directly beneath the regular machine arbor and was supported at its inner end by part *A* and at its outboard end by part *B*, both of which were vertically adjustable within very close limits. Part *A* was rigidly securable to the milling-machine column and *B* to the supporting arm, which was reversed on the machine to permit easy attachment of *B* to the studs. The lower arbor was positively driven by a pair of 8-pitch gears 2 in. wide mounted directly on the respective arbors. Each arbor carried two cutters properly spaced by a collar.

Outside of the cutters at either end of each arbor were sizing collars carbonized and carefully ground. These collars had to be true, fit the arbor perfectly and all of one size, as the accurate setting of the cutters depended upon them. These and the spacing collars were as large in diameter as practical to use and allow for grinding the cutters to their lowest diameter.

The tailstock, Fig. 2, carried two fixed centers and

the headstock, Fig. 3, two adjustable centers, which latter could be locked in position, their location with reference to their relative movement being determined by the tool-steel index plate *A*, which was doweled to the headstock. This index plate was grooved with radial slots spaced at 90 deg., being corrected after hardening.

When used with the dogs *B*, which were secured by a nut to the tapered end of the propeller shafts, it was possible to get very accurate indexing and to allow the shafts to lie very close together. A careful inspection of this system will show that the taper of the shaft may be off center to any extent without effecting the accuracy of the indexing.

The setting gage, Fig. 4, consisted of the ¼-in. thick steel plate *A* narrowed toward one end and having the edges ground straight and true. To this was secured the sliding cross-piece *B*, which could be secured at any desired point.

The method of setting the cutters was to measure their diameter (which was the same for all four cutters), calculate the distance between the sizing collars and set the cross-piece *B* by micrometer measurement, the end *C* of the slide corresponding to the center line of the collars when in contact with the gage. By then inserting the gage between the sizing collars it was easy to set the cutters to very close limits by means of the various adjusting screws. After a trial cut corrections were easily and quickly made by use of the setting gage.

Supporting the Table

As the longest shaft was over 50 in. it was necessary to extend the table, and to properly support this extension a column of cement was built up, carrying at its top an adjustable roller device which could be used to raise or lower the end of table within close limits. This was found necessary as the square was required to be parallel with the axis of the shaft.

A shaft-supporting vise of special design was used with the long shafts to prevent vibration and deflection of the shaft during the operation. It was rigid, quick in action and did not spring the shaft in any way that would effect the accuracy of the squares. It is shown in Fig. 5.

The lower cutters were lubricated by the excess oil with which the work was flooded and no trouble was experienced from this source.

The gears were carbonized to minimize wear and were protected from chips by a metal guard having heavy felt packing rings at the collars. The guards were in two pieces to allow the cutters to be adjusted and were filled with hard oil which served to lubricate the gear and to exclude minute chips.

The gears were each of 35 teeth when the cutters were new, but gears of a lesser number of teeth were substituted as the cutters were ground down. It was found however to be necessary to limit the variation of the meshing gears to one tooth (as a 33 and a 34 tooth gear), as the machine arbor did not run true and a series of ridges and hollows, the depth of which corresponded to the amount that the cutters run out, resulted where the gear teeth varied. By limiting the variation to one tooth the ridges were quite close together and were removed in the hand-finishing operation.

Where exact work is required the mating gears must have the same number of teeth, and by cutting them deeper than normal in some cases and not so deep in others close adjustments may be obtained. This work does not demand that the gears run exactly on the pitch circle.

The shafts when placed in the machine were of the temperature of the room, but the temperature began to rise steadily as the operation proceeded until the variation from this cause amounted to 0.001 in., distributed from the starting to the finishing point. This was one reason for hand finishing. To overcome this we contemplated cooling the oil and establishing a comparatively low point at which the temperature would become stable, then heating the shaft to that temperature before placing it in the machine, but this was not done.

The shafts were 1⅞ in. and 1¾ in. respectively, and were milled up from 2 in. on some to 4½ in. on others. The measurement across the flats was 1.373 in. with a tolerance of 0.0005 in. The rotative speed of cutters was about 40 r.p.m., with 0.9 in. per minute table feed. This gave over 30 hours' work before changing the cutters, which took about two hours.

The average production ran from 6 to 8½ ends per hour, according to the length to be finished. As a comparison of the output of the double-shaft attachment compared with that of the single, the latter milled at the rate of 3.8 per hour against over 6 per hour for the same shaft on the double machine.

In an attachment of this kind close and careful work is required on the fixture itself. The limit of its work will be determined by the cutters and the power of the milling machine.

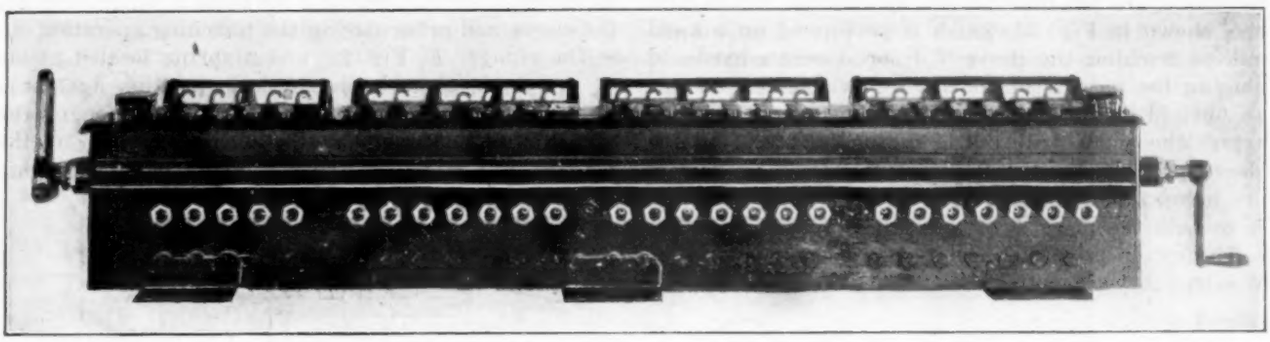
Recutting Files

By S. A. Inscoe
Wolverhampton, England

With regard to recently published articles in the *American Machinist* concerning the recutting of files A. Leigh, page 456, Vol. 49, says that there is no reason why a recut file should not be as good as a new one.

A skilled fitter or toolmaker knows a recut file at a glance and certainly has a prejudice against it. After a file has been used to its limit and sent to be recut a considerable amount of steel has to be ground off before it can again be cut; it then becomes so thin that it cannot withstand the blows of the cutting without changing its shape somewhat, with the result that when rehardened it will in most cases be found to have warped and twisted and any latent flaws intensified. Another point: Some time ago I was in an old-fashioned shop where recutting was done and I was watching a man grind the teeth off some worn files preparatory to recutting. This was not done mechanically, as I expected, but by hand on a large wet grindstone, with what results may be imagined. I have seen 8 and 10 in. flats, half-rounds and three-squares issued with which it would be a sheer impossibility to file a piece of work flat, and on account of being so light they could not be used for rough work. The only files that pay for recutting are the heavier types, such as large squares, known in some trades as "rubbers," and large three-squares.

The sandblasting and acid methods of cleaning are very crude, and in fact not much more efficacious than the wire brush, and the men who could be deceived by files so recut were probably war-time mechanics.



Manufacturing a Mechanical Lubricator—III

By M. E. HOAG

This article, the third of a series upon the methods used in the manufacture of a mechanical lubricator, goes somewhat into detail in the matter of operation upon the smaller parts which require to be finished to a high degree of accuracy. It contains a description of several sets of very ingenious tools which have been devised to secure accuracy and interchangeability of these parts, and though they are specially made for this work they embody principles that may be adapted to other work of a similar nature.

THE adjustable sleeve for the sight-feed measuring plunger, as shown in Figs. 19 and 20, is a steel drop-forging and must be very accurately finished. The piece is first drilled and reamed in the jigs shown in Fig. 21, which are of very simple construction. The body *A* of each jig has a recess to receive the work, which is held in place by the clamp *B* and the two threaded studs shown in *A*. Two slotted nuts serve to clamp the piece.

Owing to the shape of the sleeve it is not necessary to remove the block *B*, loosening the nuts giving sufficient room for inserting and removing the piece. Six jigs are used on a four-spindle drilling machine, the jigs being made to slide on the ways *C*, which are V-shaped on top and have two bearing surface on the front, as shown in the illustration, allowing the jigs to be lifted off the ways. Thus two jigs can be used on each pair of drill spindles while two extra jigs are being loaded. The drill bushings are carried on separate supports back of the ways. This combination of jigs gives a very high rate of production on this work.

After being drilled and reamed the pieces are slipped onto a plug arbor in a hand milling machine and the outside diameter rough-turned, the lug faced and the piece necked for clearance next to the lug as seen in Fig. 19. The small hole in the lug is then drilled and the piece is ready to be slotted. Reference to the drawing, Fig. 20, shows three slots which are $\frac{5}{16}$ in. long by 0.081 in. wide and irregularly spaced around the barrel of the sleeve. The making of these slots, owing to their small size, the small diameter of the sleeve bore and the thickness of the wall constitute a difficult problem for the tool designer. To perform this slotting at a reasonable cost,

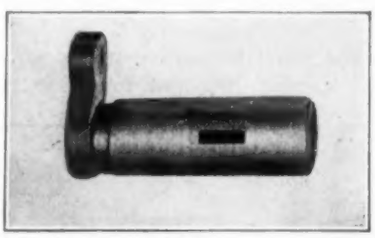


FIG. 19. THE ADJUSTABLE SLEEVE

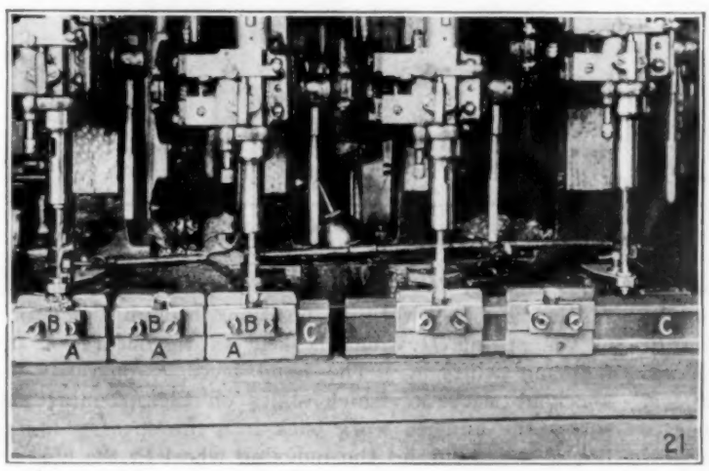


FIG. 21. DRILLING AND REAMING JIGS FOR SLEEVE

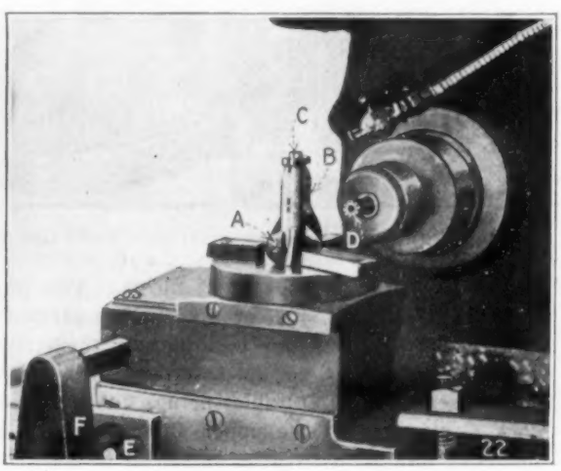


FIG. 22. FIRST OPERATION IN SLOTTING

the pieces are put through two operations. In the first one, shown in Fig. 22, which is performed on a hand milling machine, the sleeve is dropped over a hardened plug in the base *A* of the fixture, which also carries an upright *B*, on the end of which is a pin *C* which enters the small drilled hole in the lug, locating the sleeve properly on the fixture. No clamping devices are necessary, as the tendency of the milling cutter *D* is to hold the piece down onto the fixture.

The cutter is special, but it is shaped much like a Woodruff keyway cutter and it cuts the slot part way

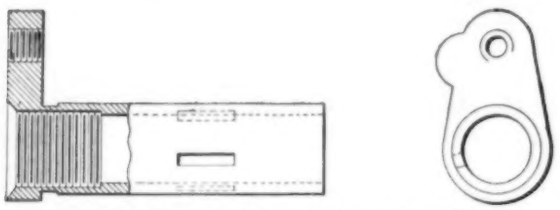


FIG. 20. DETAILS OF ADJUSTABLE SLEEVE

through the wall of the piece. The milling-machine table is operated by a hand lever, and as the work is brought back from the cutter the pin *E* strikes a stud on the fixed arm *F*, automatically indexing for the next cut. The return of the table after the last cut thus leaves the fixture ready for the first cut on the next piece. This is one of the operations handled by women, and it is surprising to note the speed attained.

After this operation the metal remaining in the slots is punched out and the openings brought to size with the tools shown in Figs. 23 and 24. The punch is made from ground tool-steel stock and is carried in the holder *A*, Fig. 23, being supported by the stripper *B*, which is free to slide up and down on the holder, and is backed up by suitable springs. A hardened-steel block *C* attached to the upper slide serves to operate the index lock *D*, as will be described later. The view from the back of the die in Fig. 24 shows the arbor *A* which receives the sleeve and the block *B* which supports the sleeve and arbor during the punching operation.

The plunger *E*, Fig. 23, and a spring located inside of the sleeve *G* holds the work in position against a block containing a locating pin in the portion of the tool *F*. To load the die the operator pulls out the plunger *E* and passes the sleeve to be punched into

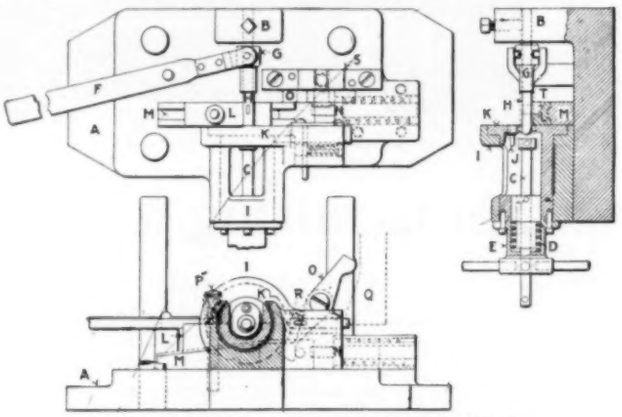


FIG. 25. DETAILS OF SLOTTING TOOLS

the opening seen in the top of the die under *F*, then through an opening in the piece *F*, onto the end of the arbor. The pin in *F* enters the small drilled hole in the lug of the sleeve and locates the slots with relation to the punch. Upon releasing the plunger *E* the spring holds the piece firmly in position.

Drawings of these dies are shown in Fig. 25. Referring to the various parts, *A* is the base, of which the rings support *B* is an integral part; *C* is the plunger for holding the work in position through the action of the spring *D* which is held in the sleeve of the indexing wheel *E*. The hand lever *F* operates the knockout sleeve *G* which slides on the arbor *H* and forces the finished work back into the opening in the boss *I* which carries the indexing wheel *E*, the plunger *C*, the locating pin *J* and the index plate *K*. The

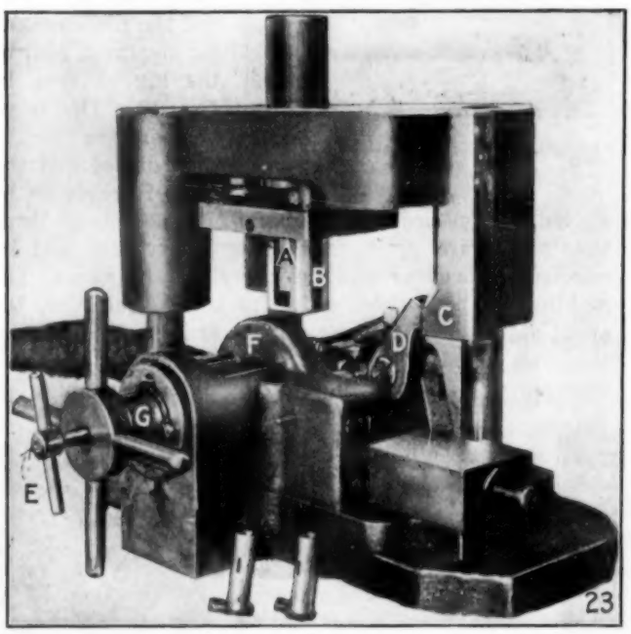


FIG. 23. TOOLS FOR THE SECOND SLOTTING OPERATION

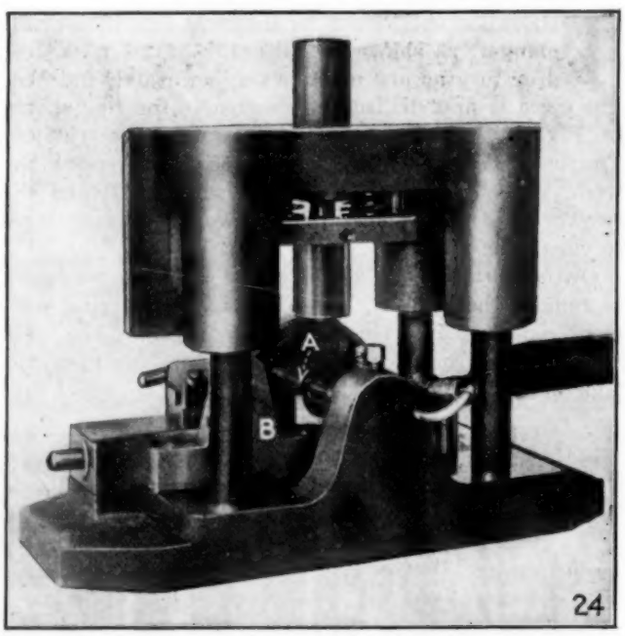


FIG. 24. BACK VIEW OF SLOTTING TOOLS

block *L* supports the work and arbor during the punching operation, and this block is backed up by the sliding wedge *M*, which is forced forward on the downward stroke of the press by the spring-actuated plunger *N*, being withdrawn on the upward stroke by the lever *O*, through the action of the steel piece shown in dotted outline at *Q*, which is attached to the sliding head of the tool. This same lever also operates the indexing pin *R*, which enters the notches in the index plate. The downward stroke of the press causes the piece *Q* to release the lever *O* which permits the spring-actuated plunger *N* to force the wedge *M* forward, raising the support *L* into position and at the same time seating the index plunger in a notch in the index plate, which has already been turned to position by the handwheel *E*.

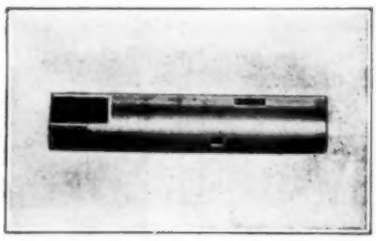


FIG. 26. THE SIGHT-FEED PLUNGER

The wedge *M* and support block *L* are held down by a spring on the stud *P*, and the lever *O* is held by a shouldered and threaded stud in the block *S*, which is doweled and screwed to the base.

An opening through the arbor *H* acts as a die for the punch and permits the punchings to fall through and pass down the incline in *L* shown at *T*.

After punching the three slots the principal operations on the sleeve are hand-reaming the hole, tapping, and grinding the outside to fit the barrel in which it is to work. This fitting must be very carefully done both on the sleeves and the plungers, for when operating against high pressure a slight variation between the diameters of the barrels and their plungers would cause a leakage of oil and the proper feed would not be maintained. The allowance for fit between these parts is about 0.0001 in., and as it would be impracticable to ream and grind the parts in lots and assemble from stock, each barrel is fitted with its own sleeve and plungers.

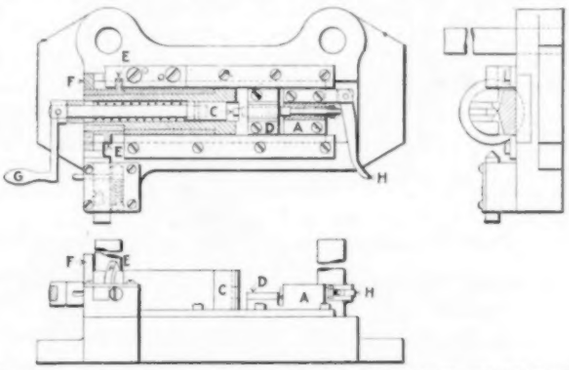


FIG. 29—SLOTTING TOOLS FOR SIGHT-FEED PLUNGER

The sight-feed plunger shown in Figs. 26 and 27 is somewhat similar to the sleeve just described in that it has three slots, but these slots are of different sizes, two of them being 0.09375 in. square, while the third one is 0.09375 in. wide by 0.21875 in. long, and they are located at different distances from the end.

The punching of these slots is done in a die somewhat similar to the one just described for the sleeves, but owing to the small diameter of the hole in the plunger no arbor is used, the punch piercing the walls and knocking the punchings through into the bore.

The dies for this work are shown in Fig. 28. It will be noted from the illustration that the punch is carried in a heavy holder and is supported by a stripper.

FIG. 27. THE SIGHT-FEED PLUNGER

The drilled end of the feed plunger is held by a spring-actuated rod in the sliding support *A* against a recess in the chuck *C*, which is formed to take the milled end of the work. A support block *D* is also provided under the work.

The most interesting feature in connection with these dies is the combination of cam and indexing plate which indexes the piece for punching and at the same time moves it endwise to obtain the correct location of the slots with relation to the end of the piece. A double throw on the cam causes the punch to make two strokes on one position of the index plate and so produces the oblong hole. The cam, index plate and handle which operate them are shown at *E*, *F* and *G* respectively. The lever *H* operates the plunger which holds the piece in position. The entire mechanism is moved back and forth in the base of the die by the cam which is at all times held in contact with its roller by two heavy springs *B*. Drawings of these dies are shown in Fig. 29, the various parts being lettered to correspond to Fig. 28.

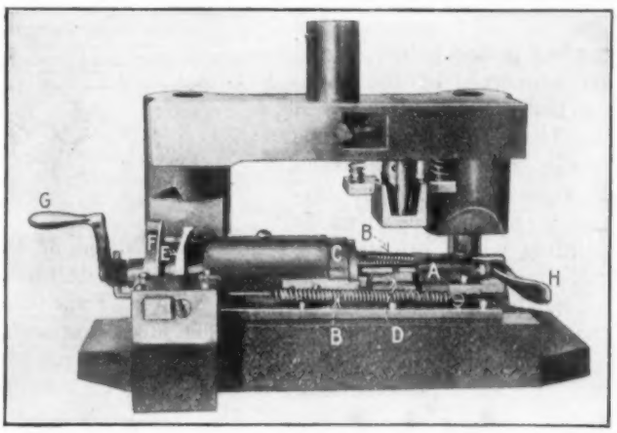


FIG. 28. TOOLS FOR SLOTTING THE SIGHT-FEED PLUNGER

In building the lubricator it is necessary to punch one or more sets of connection holes in the tanks, the number depending on the number of feeds to be served by the lubricator, and as these holes must be accurately spaced a set of dies for each size of tank would be a very expensive proposition. Also the distance from the ends of the tank to the holes varies in different lubricators so that the ordinary form of die would hardly handle the work in a satisfactory manner, therefore the adjustable die shown in Fig. 30 has been developed.

This die is built into the press and contains a number of features that might be of value on other work of

a similar character. After the steel for the tank has been sheared to size and the flange on one edge rolled, two large holes, one of which is seen at *A*, are punched. It is from these holes that the location is taken for the connection holes.

In the piece shown, two sets of these connection holes may be seen in two groups of five pairs of holes each. To punch these connection holes the stock is passed under the punches behind the piece *B*, and the large holes *A* located by the hardened plugs *C* and *D*. One of these holes, not shown in the illustration, is larger than the one that is shown, and in the case of a left-hand tank their positions are reversed, so for this reason the plugs *C* and *D* are removable and may be reversed for the purpose of handling left-hand tanks. A series of holes is provided on the right end of the carriage to accommodate tanks of various lengths. The punches are carried in the holder *E* and are supported by the stripper plate *F*. The dies are in the block *G* which can be readily removed to sharpen or replace. The rod *H* carries a number of movable pointers which are used to locate the position of the work under the punches, the position being determined by moving the carriage until the pointers come over the centers of the plugs *C* and *D*. The piece *B* operates a ratchet under the bed of the press and feeds the carriage ahead automatically as each pair of holes is punched, a rack and pinion being provided for that purpose.

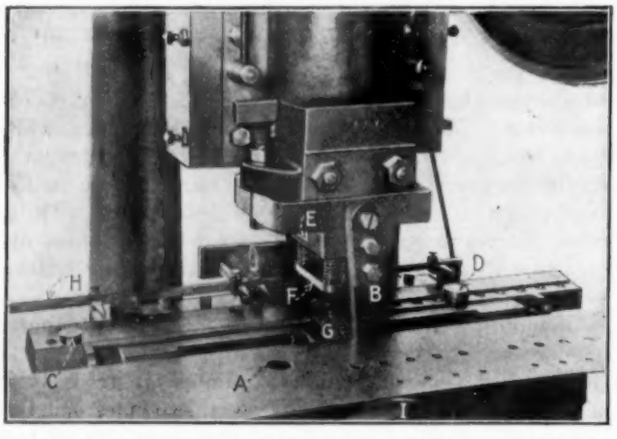


FIG. 30. ADJUSTABLE PIERCING TOOLS FOR TANKS

On the back of the carriage a heavy rack is cut for the proper spacing of the holes in the tank. Heavy springs operate a plunger which enters the spaces in this rack as the press ram starts down, positively locating the carriage which has been brought as nearly as possible to the correct position as indicated by the pointers.

A lever is provided under the bed of the press by which the workman can disengage the feed rack and ratchet, and by pushing in on the handwheel *I* and turning it at the same time can, by a clutch which is thus operated, feed the carriage in either direction to any desired position. These features are made plainer by the drawing, Fig. 31, in which the index rack is shown at *A*, the index plunger at *B* and the carriage with the holes for the locating plugs at *C*. The feed ratchet is shown at *D* and the lever which operates it at *E*. At *F* is shown the hand lever by means of which the ratchet is disengaged to permit feeding by hand.

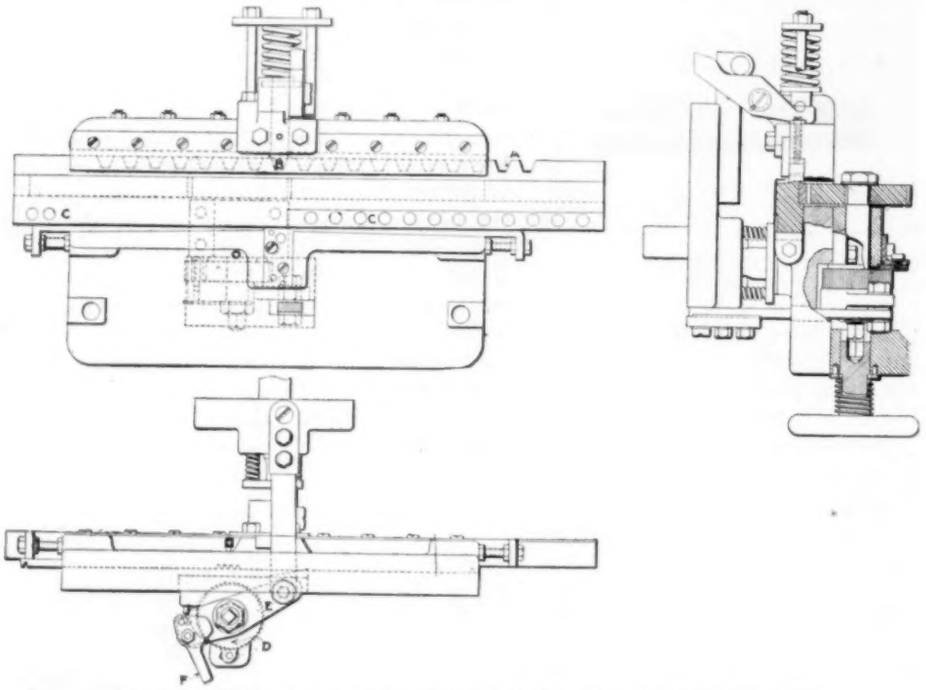


FIG. 31. DETAILS OF ADJUSTABLE TOOLS FOR PIERCING TANKS

The end view shows the arrangement of the handwheel, clutch, ratchet, and rack and pinion, and it also shows the arrangement by which the indexing mechanism is operated. It will be noted that adjustable wedges or gibs are provided for taking up wear between the carriage and the ways in the base of the die.

Fewer Business Failures in November

Business failures during November numbered only 560 compared with 674 failures the month before and 972 failures in November, 1917. Total liabilities of the failed concerns were less than $12,000,000 compared with slightly over $12,000,000 in October and slightly over $12,000,000 in November of last year. There have never been so few business failures in any month since the panic period of 1893, a full quarter century ago. In the readjustment of business to peace conditions some failures are inevitable, but every indication points to a lesser number of failures than in the corresponding months of the preceding years unless we are deluged with shipments of manufactured goods from Central Europe—goods which they have on hand and which they need much less than they need money and foodstuffs.

Markets for the American Machine Tool

By L. W. ALWYN-SCHMIDT

The effect of the late war on the machine-tool industry of the United States is of course problematical. However, it seems reasonable to suppose that during the reconstruction period which must necessarily follow the devastation of the past four years Europe would have her hands full in supplying her own needs, and other countries, especially those of South America, would naturally look to the United States to meet their requirements.

MACHINE-TOOL makers interested in foreign trade should find valuable reading in the export statistics for the last four years just published by the United States Department of Commerce. Excluding the rapid export growth of machine tools and metal-working machines to England, France, Italy and Russia caused by the war, and which most likely will subside now that the conflict is over, there has been increased exportation to markets not immediately connected with war trade which promise further growth.

England, France and Italy will not cease to buy American machine tools, and might continue to be the most prominent of our customers, but it would be a mistake for our machine-tool manufacturers to rely entirely on the good-will of these three industrially strongest of our allies and neglect to secure connections in the less active markets of Scandinavia, Spain, Portugal, South America, the Asiatic East and other parts of the world. These markets are now undergoing a great industrial reorganization which is reflected in our foreign commerce in machine tools.

Reports of Commerce Experts

There is hardly a week that United States consuls and commerce experts in Scandinavia and the Netherlands do not report some evidence of increasing industrial activity. Cut off from their usual markets of supply—England, Germany and France—they have settled down to manufacture what they require themselves. Sweden now makes piano strings and electrical, agricultural, wood-working and other machines. Norway has spent during the last year $7,000,000 in expanding her metal and mechanical industry. Nearly $2,000,000 were invested in electrical equipment, and millions more in new textile enterprises, mining, etc. Denmark has taken up the manufacture of typewriters; has extended its famous cream-separator industry, and is making electrical appliances in increasing quantities. The Netherlands has made great progress in the building of machinery; strengthened its shipbuilding facilities, founded new photographic apparatus and appliance factories and established other industries.

None of these four countries had been big customers for American machine tools before the war. The Netherlands in fact had several factories making machine tools and even has been a successful exporter. The proximity of the Belgian, German and English machine-tool industries further made it unnecessary for Scandinavia and the Netherlands to come to the United States for anything but the best machine tools, and only the latter were imported before the war from the United States.

Now the supply of European machine tools has ceased, and with a growing demand the four countries turned to American supplies. Manufacturing methods have undergone considerable change. Men have not been available because these countries took their armies off a peace footing, so production had to be speeded up to keep pace with the national demand. American labor-saving machinery was not merely a convenience but a necessity.

Denmark, which before the war averaged about $80,000 in orders for American machine tools, placed orders in 1915 amounting to $247,000 and to $338,000 last year. Norway increased her orders from $80,000 in prewar times to $356,000 in 1917. Sweden kept her purchases at about the same level as ordinary times, except that in 1915 $621,000 worth of machine tools were bought, though it has been intimated that part of this purchase was for German buyers. In 1917 the Swedish industry bought American machine tools to the amount of $313,000.

The Netherlands

The Netherlands appeared late in the American machine-tool market, as it had an industry of its own which was able to cope with the local demand during the first years of the war. Its first orders of importance was for $331,000 in 1916. In 1917 the machine-tool purchases rose to $436,000, making her the largest purchaser of American machine tools among the four leading north European neutrals.

Incomplete statistics for 1918 show that the demand for machine tools from these countries has remained about the same as in the preceding year. The question now is, Will these countries continue to buy on the same scale in future? The machine tool shipped by this country to England, France and Italy and that going to the Netherlands and Scandinavia has been a totally different kind. The first mentioned received principally special machines built for the munition industry, while those supplies to Scandinavia and the Netherlands were mostly automatic tools for general manufacturing. None of these will have to be scrapped after the war, but on the contrary they will form part of the after-war industrial equipment of these countries. It is not known whether the machine tools so far supplied have been sufficient to meet the demand, but it is thought that the American tools supplied during the last two years have been just enough to keep manufacturing going, and that all four markets will try to buy more tools as soon as they can. Having got acquainted with American tools it is almost certain that the American types will be continued with the result that American machine-tool makers will find a permanent outlet for their product in this direction.

Spain is another of the neutral countries of Europe

which has adopted American machine-tool equipment since the war began. Spanish manufacturing methods were undergoing a gradual change at the time the war broke out, and manufacturers had started to test American tools. Being thrown on their own resources by the interruption of supplies of many industrial products formerly purchased abroad their manufacture in Spain became necessary, and this immediately brought large orders for American machine tools. Spanish trade in this line, amounting to about $100,000 in prewar times, suddenly increased to $776,000 in 1916 and $1,686,000 in 1917. Conditions in that country seem to be different from those in northern European neutral countries. Unlike these Spain has accepted large orders for war materials on behalf of France and recently also the United States, and part of the machine-tool equipment sold to Spain consists of special equipment for armament factories.

Antedating the war the German machine-tool industry had in Spain one of its best customers. Now the American machine-tool industry has taken the place of the German. Recent Spanish purchases of machine tools have been larger than ever, and this may be explained by Spain not having been able to buy her usual quota of machine tools to renew her industrial equipment during the first years of the war had to increase her orders during the following years. Coupled with Portugal, which also has bought more American machine tools than ever, the Iberian Peninsula should become a very valuable customer.

Switzerland a New Market

Among the new markets for American machine tools in Europe is Switzerland. In 1917 this country bought American machine tools to the amount of $117,000, or more than six times its prewar purchases.

The sale of machine tools depends on industrial development. Only where manufacturing is done on a large scale can machine tools be employed in great numbers, and the demand of a country for them is an indication of industrial progress. The export trade in American machine tools, the only ones obtainable in the open market since the beginning of the war, should therefore be of interest to the student of international markets not only as to its effect on home industry, but as showing the industrial development undergone by many countries during the last four years. The little state of Panama, for instance, which had practically no industries in the past, is now a large buyer of American machine tools, her trade amounting to $97,000 in 1917 against $10,000 in previous years.

In Cuba numerous factories have been started, and a good deal of machinery has been imported, which in turn has raised the demand for repairing facilities. There are several shipyards on the island, and the sugar plantations require much special machinery. The effect of all this has been a machine-tool business with the United States in 1917 amounting to $334,000.

Up to 1913 the principal consumer in South America was Brazil, which took $346,000 worth of machine tools in that year. Argentina took $112,000, and Chile $43,000. Before the war South America relied almost entirely on the European manufactured goods. The then existing industry was satisfied to do repair work, and manufacturing was very limited. Conditions now are entirely different. Industries that in prewar times were merely supplementary are now principal ones. Brazil makes press buttons, toys, ships, locomotives and even machinery. Argentina, it is said, has nearly doubled its industrial capacity during the last four years. But the greatest progress seems to have been made on the South American west coast, in Chile and Peru, where American capital has been very active. Foreign commerce in South America has invariably followed investment of capital.

Brazil, being industrially the most progressive among South American countries, has been able to get along with comparatively little new machine-tools, only $55,000 having been sent by American manufacturers during the last year. Argentina, being not so well provided as her northern neighbor, took $154,000 worth. The most important buyer was Chile, which spent in 1917 on American machine tools $426,000, nearly 10 times more than her requirement five years ago. Peru raised her purchases from $40,000 to $71,000.

South American Market

The future of the South American market for American machine tools raises an important question: Will South America return to the use of European machine tools, or will it continue to purchase the American product? The reasons why European tools have found preference in South America are many. Price, design, local industrial methods and so on have favored the European article. Comparatively no doubt the American tool was more expensive. In the meantime, however, things have changed. Europe will not be able to manufacture as cheaply as before, and European machine tools will consequently become more expensive. Of course American machine tools are also more expensive than formerly, so it must be left to the future to show whether the American price increases are high enough to neutralize the increase of European prices.

The South American market requires a tool of simple design, more or less foolproof. There is a lack of trained men to handle the more complicated American machine tools. American manufacturers may decide to make special machine tools for the South American market or they may elect to send to South America engineers trained in running American tools with the object of training men there for their special work. The latter course most likely will appeal to American enterprise and it is doubtless the best.

Already there is a demand for American engineers in many parts of the world. They may go to take charge of American-owned machine shops or as representatives of American manufacturers. Other countries have followed this practice for a long time, and America may be compelled to do likewise. The engineer not only is much better enabled to sell a new machine, but he can assist in putting it up and in making necessary repairs.

As to Asiatic countries the principal markets in that part of the world have increased their purchases of machine tools in this country. China bought to the amount of $3192 in 1913 and raised her requirements to $119,245 in 1917. British India increased her purchases from $43,717 to $273,744 and Japan from $119,588 to $1,092,317. A practically new market has grown up in the Dutch Indies, the trade with these islands

being $245,000 in 1917 compared with $6366 in 1913.

The demand from Australia and New Zealand has undergone little change, but Australia offers as a whole a larger market today than before the war. South Africa on the other hand has developed a greater interest for American machine tools, having purchased to the extent of $143,582 during 1917 against $27,671 four years ago.

This all is a very good showing for the American machine-tool industry. Allowing that $50,000,000 of the total export value of $84,000,000 for 1917 consists of so-called war business the exports to markets indirectly affected by the war has more than doubled. The American machine-tool industry has had its great chance. American tools have been introduced in many shops where they were not found before and they are bound to stay. They will help to speed up manufacturing in many countries, with the result that demand will arise for additional American equipment. So the outlook for the American machine tool industry is very good even though the great war exports come to a sudden end.

Draftsman or Engineer

By E. H. Michaelis

After reading the article by G. J. White on page 907, Vol. 49, of the *American Machinist*, and that by B. H. Walker on page 1075, it does not take a clairvoyant to see, that Mr. Walker is a practical shop man while Mr. White is a college graduate. Mr. White calls attention to the scarcity of draftsmen, which he says never existed before, and later he refers to the product of night courses as half-baked draftsmen.

Let us look at the development of the kind of draftsmen we used to find in every drafting room before the war and maybe will find again. A boy having a grammar-school and possibly some high-school education or a graduate of a manual training school is taken on as an apprentice. He is shown how to make blueprints, and during the time not taken up in this work he is taught to make tracings. After he has learned how to use his drawing tools he is given some detail work, which means as assembly drawing made by an experienced engineer, in which every part is shown, his work being to copy the different parts on detail sheets. He is then shown how to give the necessary dimensions, and after more or less of this experience he feels that he has mastered his trade as a draftsman and is the equal of any college graduate.

This is the kind of draftsman of which there never was, is not and never will be any scarcity. His species is the root of nearly all the trouble existing between the shop and the drawing room, and he will exist only so long as he is given no real engineering work to do. When the war came and the Government insisted on speedy and accurate work he was unable to meet the requirements—then there was a scarcity of draftsmen.

The product of the above-described course is never anything but a so-called draftsman. He cannot fill a responsible position, and if he wants to become more than an underling, always having to be told what to do and how to do it, he must acquire some certain knowledge.

This knowledge consists of two essential parts, one the theoretical and scientific, of which Mr. White is the exponent, and the other the practical shop knowledge, of which Mr. Walker is the champion.

There has always been antagonism between the shop and the office engineer, and the reason therefor is on the one hand the contempt of the shopman for the man with the white collar, who gets his knowledge out of books and is afraid of dirtying his hands, and on the other the conceit of the college graduate and his associate, the draftsman, that he is superior to the shopman in knowledge and social position.

Both are wrong. The shopman needs the knowledge of the office engineer and the latter requires the shopman's experience. The theoretical man is as valueless without practical knowledge for the purpose of producing good work, such as designing practical tools, as the shopman would be without theoretical knowledge should he undertake to do the work of a designing engineer. I purposely use here the word "engineer," because any dub can do the work of the so-called draftsman.

A college education however is not necessary to gain theoretical knowledge. Mr. Walker is right. Any ambitious man with a little money can become as good a designer as any ever graduated. But just the same he must get the theoretical knowledge. He must study mathematics, mechanics, etc., which he can do by taking a course in a good correspondence school or by studying a good technical library. And if he has sufficient willpower to stick to his studies he can become just as good an engineer as the college man.

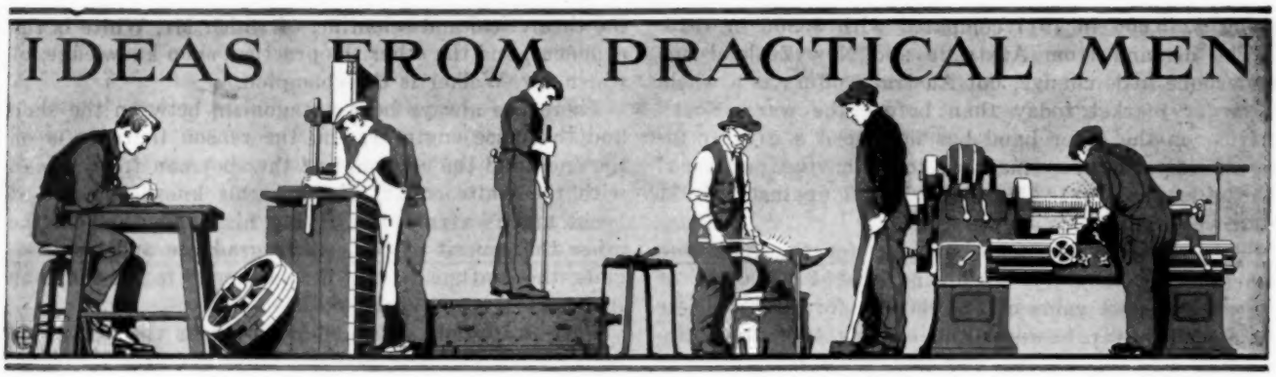
And just as the practical man has to acquire theoretical knowledge if he wants to become a designer so must the college graduate acquire practical knowledge before he reaches practical efficiency. His college may have given him the title of engineer, but in order to be an engineer he must have acquired a considerable part of the shopman's experience. For that reason it is advisable for him to start his career as a detailer in the drafting room, but he should be given the opportunity to follow up the work that he puts on paper. In order to gain the practical knowledge necessary to supplement his theoretical education he should be allowed to study methods in use in the shop and get whatever information he can from the viewpoint of the shopman.

To become a real designer a man has to spend at least four years in school and three in the shop, or he has to learn his trade as a machinist, which takes four years, and then study evenings and in spare time to get the theoretical knowledge.

What inducement has a man to spend time, money and work to gain the knowledge necessary to fill a designers position? A draftsman receives at best but $90 or $100 a month to start with—in normal times only about $75—and after four or five years' experience he may possibly get $125 a month, and that is about the limit.

There are a few exceptions, where through some cause or other a draftsman makes better money, but these exceptions are very few.

Why should anybody want to stick to a losing game year after year? Why should a college graduate work for a pittance when he can get better pay in other lines? Why should a toolmaker or machinist spend time, money and energy to become a designer, when he knows that the additional knowledge not only does not pay him more, but rather less than he earned before?

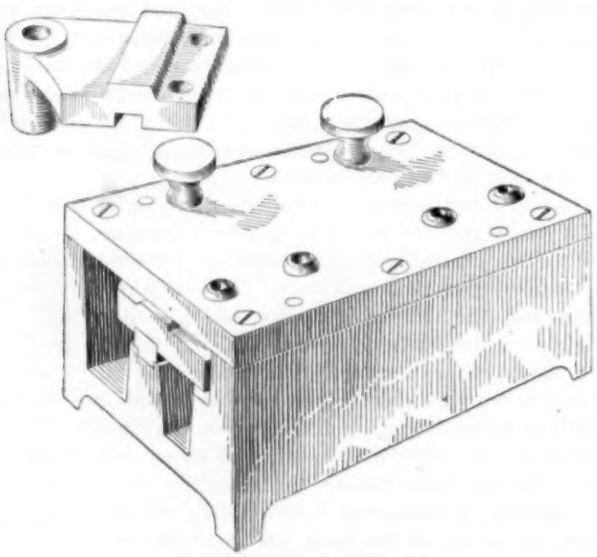


A Duplex Drilling Jig

By H. E. McCray

An example of a reciprocating or alternating drilling jig is shown in the sketch. Its purpose is to drill two $\frac{21}{32}$-in. holes $\frac{3}{8}$ in. deep in cast iron, and it delivers the parts at the rate of 200 finished pieces an hour.

It is used in a two-spindle drilling machine with automatic feed, and the operator can be removing a drilled



A DUPLEX-DRILLING JIG

piece and substituting an undrilled one at one end of the jig while the drills are working in the other one.

As the drilling is completed the operator raises the drills, moves the jig to the other position, bring the drills down to the work and engages the feed.

The pieces are located in the jig by the hardened and ground plug which enters a hole that has been drilled and reamed in previous operations.

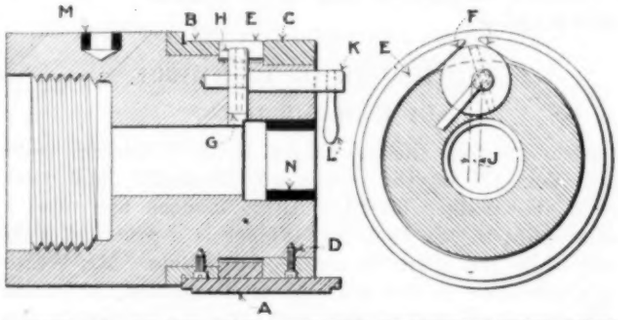
A Special Expanding Ring Chuck

By Herbert Mather

A special form of chuck for turning rings made of wrought-iron pipe is shown by the illustration. The rings indicated at *A* are first gripped in a regular chuck and the hole bored to size, which is a slip fit over the rings *B* and *C* of this fixture. These latter rings are hardened and ground and are held in place by screws *D*. Between these two rings is placed a third ring *E*, which is made of tool steel hardened and spring tempered. This ring is split and has the edges beveled back as shown at *F*.

In the body of the fixture at *G* a slot is cut, and a disk *H* having a hole in it which is off center, as indicated by *J*, is placed in the slot. The disk is pinned to the stud *K* and can be turned by the handle *L*.

In operation the work is held by the ring *E*, which is



A SPECIAL CHUCK FOR TURNING WROUGHT-IRON RING

expanded within the bore of the work by means of the eccentric action of the disk when the latter is turned by the stud.

Other details of the fixture are the hardened bushings *M*, in which a spanner wrench or pin is used for putting it on the spindle nose, and the hardened and ground bushing *N*, which is used to support cutting tools while turning the work.

Two Ways of Molding a Casting

By M. E. Duggan

In an article on page 510, Vol. 49, of the *American Machinist* I described how a certain cored casting could be produced without the necessity for a core box, and on page 752, Vol. 49, F. L. Sylvester "fully agrees with me," but doubts that "any foundry would have a box to make up stock cores like *C*." For Mr. Sylvester's benefit I will try to describe how these cores were made without a box.

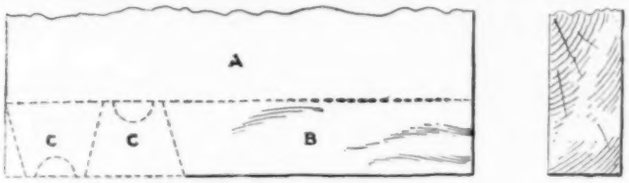
Every general jobbing foundry keeps on hand stock cores—rounds and flats—of various sizes and shapes, a flat, or "slab," core being shown in the cut at *A*. To make the cores described in the above-mentioned article a strip *B* was sawed from the slab and the cores *C* sawed out as indicated by dotted lines.

The thickness of the slab is not important; it may be more or less than the core print, but preferably more. The 16 cores required for this casting were made in 20 min. They were located on the pattern exactly as wooden prints would have been except that they were

loose. The drag and cope were rammed in the usual way with these loose cores in place, then after lifting the cope the cores were taken out, the pattern drawn, the round cores set, and the slab cores put back in the mold before closing.

The casting described by me on page 551, Vol. 49, and criticized by Sandy Copeland (page 766, Vol. 49) involved the application of the same method.

Mr. Copeland wants to know how much further down the sand would have hung had the mold been parted in the middle, and how much more it would have weighed. The answer in both cases is "Not any," nor would gaggers have been needed to support it, but if the mold



CUTTING CORES FROM A SLAB

had been made in the usual manner by parting at the center there would have been nothing out of the ordinary for me to write about.

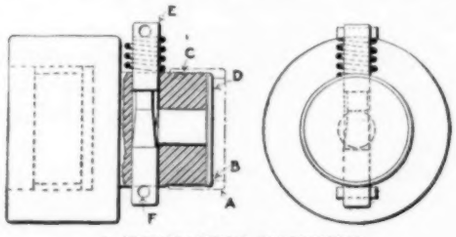
If Mr. Copeland had been "looking in at the foundry window" about this time he might have discovered that this was an unusual case where a casting was required to repair a breakdown, and if the pattern had been returned to the pattern shop (which was a mile and a half away) to make the necessary changes, including the making and fastening of 16 core prints, there would have been slim chance of pouring that day.

As there was no time to be wasted in looking up special flasks the two parts of the casting were nailed together and the pattern molded along with another pattern in a large flask, the cope half of which was a "flat back" with sand bars 5 in. center to center. This is the standard arrangement for sand bars in this foundry, and perhaps Mr. Copeland knows how the pattern in question could have been molded in the regular way without cutting away these bars.

Mandrel for Thin Threaded Pieces of Brass Tubing

By George W. Cooper

The piece shown at *A* in the sketch is made from brass tubing bored and threaded inside, after which it is necessary to turn the outside concentric with the in-



A RELEASING MANDREL

ternal thread. The finished thickness of the wall over the root of thread was but $\frac{1}{32}$ in., thus making the piece a very delicate one upon which to operate, and when an attempt was made to do the work on an ordinary screw mandrel the piece clung so tightly at the shoulder *B* that it was found impossible to loosen it without distortion.

After some experiment the present mandrel was evolved. The mandrel *C* was bored and reamed for the plunger *D*, which had a large head on one end while the other end was beveled to about a 7-deg. angle. The pin *E* fitting a cross-hole in the mandrel was tapered to match the beveled end of *D*, and a coil spring held it in the position shown with the cross-pin *F* resting on the mandrel, thus pushing the plunger *D* slightly outward.

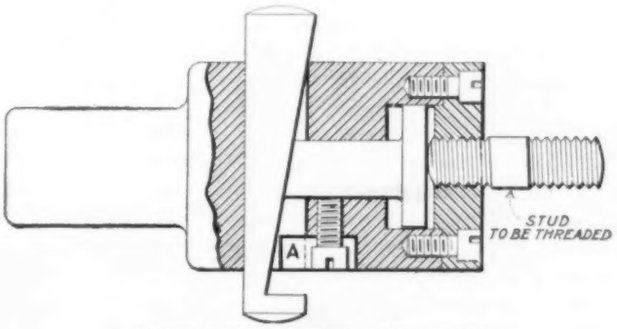
When a piece of work is completed a slight blow on the spring end of the pin *E* loosens the plunger *D*, allowing the work to be removed from the mandrel without difficulty.

Chuck for Nipples and Studs

By C. W. Putnam

On page 954, Vol. 47, of the *American Machinist* William Forray described and illustrated a chuck for holding nipples and studs while threading, in which the work was released by driving back a key which had supported the thrust upon the threaded end of the work due to the pressure of the cut.

Having occasion to use a tool of this kind I adopted



CHUCK FOR NIPPLES AND STUDS

the idea embodied in the above article, but substituted a round key for the square one used by Mr. Forray and set in the small piece shown at *A* in the sketch to prevent the key from falling out.

It is interesting to note the efficiency of this tool in service in comparison with a simple threaded sleeve from which the studs are removed with a Stillson wrench.

A Rod-Straightening Fixture

By Christian F. Meyer

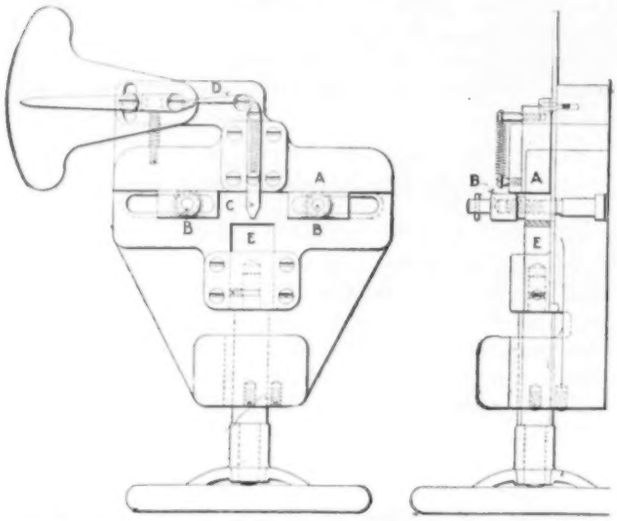
The sketch shows a rather unusual fixture used for straightening long, rectangular rods that are used in certain textile machinery. These rods are of cold-rolled steel 32 ft. long with a cross-section of $\frac{3}{4}$ x $\frac{3}{16}$ in. and they are made by joining two rods of commercial length, which is about 16 ft. The rods slide in slotted bearings lined up for that purpose, and it is therefore necessary to remove the small bends and kinks that are always found in the commercial bar.

They were formerly straightened on a long surface plate by men specially skilled in this work, the only equipment being a hammer and good eyesight.

The fixture consists of a cast-iron baseplate which is fastened to the bench. Two steel blocks are fitted to

slide along the finished-front face of the raised portion *A* and can be held in any desired position by the screws *B*. The outer surfaces of these blocks are in perfect alignment.

The gaging pin *C* projects from the face of *A* between the two blocks in position to bear upon the rod as it is passed through the fixture. To this gaging pin is attached an indicating pointer through the medium of the multiplying lever *D*. The proportions of lever and



FIXTURE FOR STRAIGHTENING RECTANGULAR RODS

pointer are so calculated as to give a ratio of 36 to 1 between the indicating scale and the gaging point.

Opposite to the gaging point is a movable steel block *E* operated by the screw and handwheel. As the work is moved along the face of the block the gaging point is always in contact with it, and the smallest deviation from a straight line being shown by the pointer this bend is removed by applying pressure on the opposite side through the medium of the handwheel, screw, and pressure block. It takes very little practice for any man to become proficient in the operation of the fixture since the pointer is an infallible guide. When the bends in one direction are removed the rod is reversed in the fixture and the other side straightened in the same way. The blocks may be adjusted to the average lengths of the short bends, which are practically always the same for any lot of rods rolled at the same time.

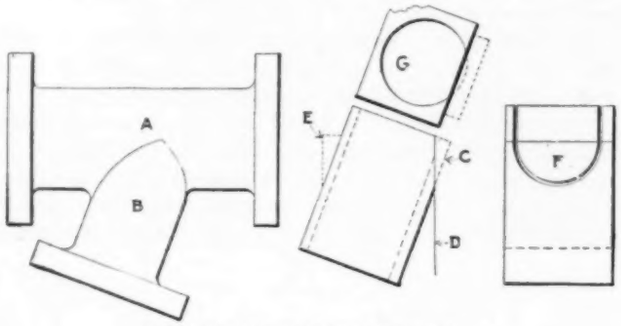
Kink for Making Angle Pattern

By M. E. Duggan

Patternmakers in a shop where fittings are made understand this class of patterns and how they should be constructed much better than I can tell. But there are times when patternmakers who seldom have any of this class of work are required to make a pattern for straight or angle T-fittings and it is then that some simple kink helps to get the pattern out in jig time if the casting is wanted in a rush, as is often the case.

Take a block of wood, split or solid as needed, large enough to make the member *B*. If split fasten the two halves together temporarily. Saw off the piece *C* on the line *D*, fastening the piece in reverse position as at *E*. Mark the circle of the body *A* on the face of this block *E*, and with the piece resting on the surface *D* saw out the piece *F*.

Leave *F*, which has just been sawed out, in position and fasten it temporarily. Take off piece *E* and fasten



FITTING AN ANGLE PATTERN

it at *G*. Mark off on end of block at *G* the diameter of the member *B* and saw it to line.

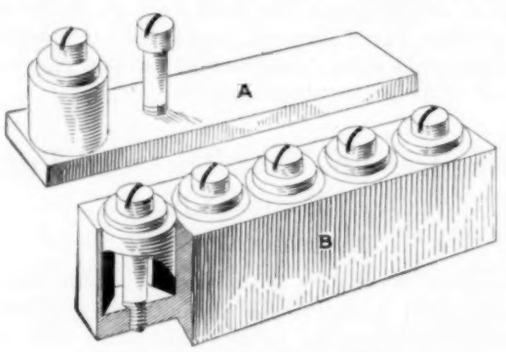
If the marking and sawing are correctly done the *B* member will be an exact fit on *A* and at the correct angle.

Improved Form of Holder for Toolmakers' Button

By Donald A. Baker

The usual form of button holder for toolmakers' use is shown at *A* in the cut with one button attached. This is simply a flat strip of metal with the requisite number of tapped holes in it to which the buttons may be fastened with their screws. This is all right so far as keeping them all together is concerned, but it offers no protection against damage from contact with other tools, etc.

To retain all the features of compactness of the design and at the same time fully protect the buttons



HOLDER FOR BUTTONS

from injury from bruising or abrasion the design shown at *B* is recommended. The author has had one of this kind in use for the last 10 years and has found it to be very satisfactory.

It is made from a square bar of cold-rolled steel into which holes were bored to receive the buttons. These holes were bored just deep enough for the button to come flush with the top, enough stock being left at the bottom so that a hole could be drilled and tapped to take the end of the retaining screw. With this arrangement the buttons may be thrown around anywhere without fear of injury.

CRIPPLED WORKERS in the MACHINE INDUSTRY

By ARTHUR J. WESTMAYR, LL.M.

This article, which tells of what is being done toward fitting the maimed for useful occupation, should be read and digested by all employers. We are now face to face with the tremendous problem of rehabilitating our war-maimed soldiers and sailors. Some are already here and thousands more soon will be. Their employment at a living wage is not a charity but a duty. We owe everything to them, for had not they gone into the front-line trenches and stopped the brutal Hun this country would now be overrun with a horde of murderers—and worse.

TIME was when every war produced its quota of cripples who eked out a precarious existence through public and private charity. But there were both excuse and justification in the past for this lack of method of caring for the disabled. No provision was made to rehabilitate them or to marshall their remaining physical powers for successful productivity. But we have learned through this war to conserve what formerly would have been waste; the salvage of man power has begun, and by rehabilitating the cripple, the shortage of labor will be greatly reduced. Today the handicapped man can reënter the ranks of labor and is accepted for what he is worth and is paid accordingly. He is no longer dependent on the benevolent appraisement of his work. He stands erect and selfreliant and demands as his due the wage his labor has justly earned. At the outset let it be understood that the disability of which we are speaking is to the extent of at least 50 per cent. of a medical nature. The disabled soldier or sailor is not necessarily a man without legs or arms. He may suffer some injury that has left no outward sign or may be a victim of gas or shell shock. Even the blind could turn their other faculties to profitable account. The employer who accustoms himself to this way of thinking broadens his views of the war cripple to his own advantage. He need not consider an operation in his factory as a possibility for a one-legged man. A great many other forms of physical handicap, involving whole men, can be drawn upon. In the machine trade a great many processes have been found in which the cripple can compete with the able-bodied man. A report prepared by the Trade Advisory Committee of the engineering trades and issued by the Ministry of Labor in collaboration with the Ministry of Pensions, England, states: "The machinist's trade is one of the most widely spread of all industries, and is at present carried on in all parts of the country in close relationship to practically all other forms of industry. As one of the key industries it plays

ONE-ARMED MAN AT WORK AT A FOOT-OPERATED SHEET-METAL-WORKING MACHINE

a very important part in the economic life of the country and predominates in large industrial centers, where it is allied to other important industries."

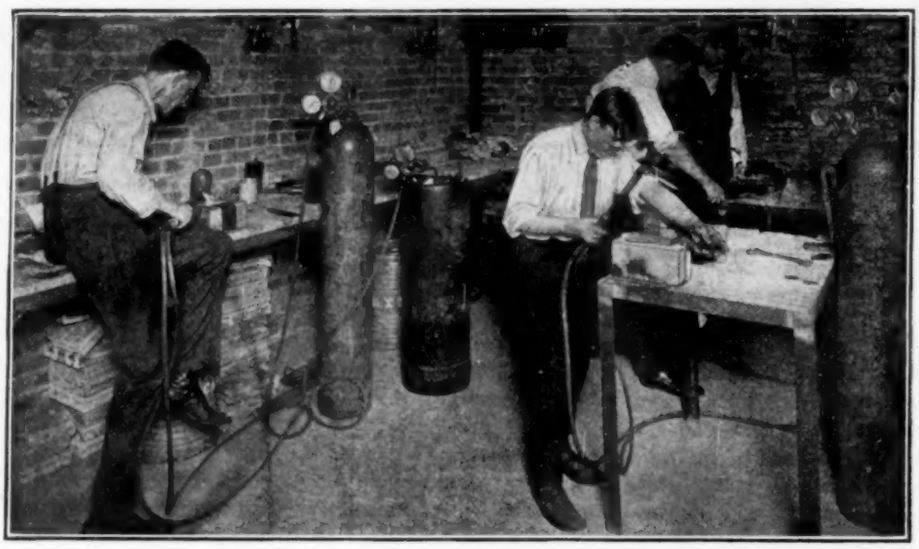
Any man who can get around on artificial legs can do all but the heaviest work in machine shops. This is the opinion of instructors in technical schools. One-armed men can do lathe work, planing, drilling and milling machine work, soldering, shaping, cutting, oxyacetylene welding and drafting. Men with leg amputations can become electricians, oxyacetylene welders, engineers and firemen. Among the minor mechanical operations they can operate turret lathes and light drilling, grinding, milling, planing, shaping, slotting, tapping, sawing and boring machines.

Even men with both legs amputated can be employed in this industry. They can be polishers, lacquerers, inspectors, testers of electric apparatus, drilling machine hands, punching machine hands, coil winders, assemblers of small machines, bench lathe hands and draftsmen. While all the foregoing occupations for leg cripples require the use of arms and hands the loss of several fingers would not disqualify the worker. The skilled trades the physically handicapped are able to follow include coppersmithing, fitting, turning, brass finishing and pattern making. Not only can machinists help the cripple by giving him employment, but they can be of even more value in giving thought to the designing of machinery with simple auxiliary control devices that will enable men who have lost a hand to operate the machines by their feet. The problem of designing machinery for the use of cripples will never be of greater importance than now, and it should receive immediate attention from designers. Leading machinists have already expressed their willingness to coöperate in adapting their products to the use of men who have been more or less crippled.

In Toronto, Canada, there was erected one of the largest steel plants in the world, comprising furnaces, buildings, presses, saw shop, railways, etc. A Cleveland, Ohio, man superintended the erection of this plant and tells how he employed about eight hundred returned crippled Canadian soldiers, and made the world's record in construction. He writes in part as follows: "Of course a little patience had to be used at first, but the men soon got used to the change and would respond quickly to kindness, sympathy and justice, and these they must have. They did not want coddling or charity, but a chance to get into the swing of civil life again."

Among the men he employed were some who had a leg or an arm amputation, men who had suffered the loss of an eye, also shell shock and gas victims. One man who had lost his right arm and left eye became a master mechanic. Before his injury he had been a pipe fitter. A lumber jack, badly wounded in the legs and feet and with a plate in his skull, made a very good lathe hand without any other training than being a helper in a machine shop. A former clerk, with shrapnel wounds in his back and side, operated an electric crane. Many such cases could be told of men whose earning capacity has increased since their injury. To these men with "their wonderful discipline, their quickness in obeying orders and their loyalty" was due the splendid world's record in construction. They not only made a record as fighting men in France, but given a chance they will make a record in the industrial world.

In the early stages of the war Belgium, France, England and Canada realized the necessity of rehabilitating the crippled soldier. Profiting by the experience of the allied countries the United States, immediately after the declaration of war, began an advanced study of how best to rehabilitate and make independent the maimed and permanently injured of our own army. No one has seen or must see an American veteran of the world war rattling pennies in a tin cup on the street corner. Schools are ready to train him and long before surgeons and doctors are ready to dismiss him he will be well on the way of preparation for his life work. The returned American soldier who has been disabled will receive not only appreciation, encouragement and financial assistance, but also a training that will prepare him to be independent. America will give her returning soldiers not merely sympathy but justice and a fair chance.

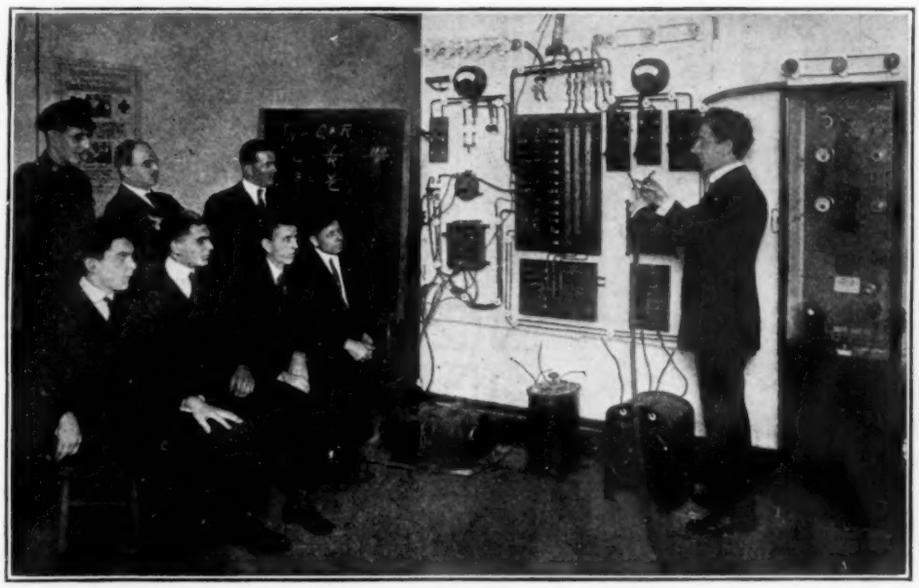


OXYACETYLENE-WELDING CLASS FOR CRIPPLED AND DISABLED MEN

According to the Vocational Rehabilitation Act recently enacted by Congress those disabled in the military and naval forces of the United States have been placed under the joint authority of the Surgeon General of the Army and the Federal Board for Vocational Education. The Surgeon General has jurisdiction from the time the person is injured until he is restored to good physical condition, when he receives his honorable discharge from the service. The Federal Board then offers him vocational reëducation and training which will enable him to return to useful active employment, and the United States Employment Service will coöperate in finding him work. While men are taking special courses, compensation will be allowed them and the allowance will

be paid their families precisely as if they were still in active service.

The Red Cross Institute for Crippled and Disabled Men of New York was established to pave the way for the war cripple. The work of the institute has heretofore been mainly with the industrial and civilian cripple. The making of artificial limbs, mechanical drafting, oxyacetylene welding, printing, motion-picture operating and the manufacture of jewelry are some of the courses which are offered free to cripples, and many skilled workers have already been turned out by the various classes. There is also an employment bureau in connection with the institute. Hundreds of crippled



TEACHING THE FUNDAMENTALS OF ELECTRICITY IN THE MOTION-PICTURE CLASS

men have been placed in positions through this bureau, and it is receiving frequent requests from employers who have experimented with this new labor asking for more. They speak of this new kind of labor in the highest terms and tell us that its productivity stands up well against the highest standards. These men approach their task with a new and better spirit, while the application and care they bestow upon it makes for the very best results both in quantity and quality of the work.

The illustrations show cripples at various kinds of employment, also the classes for instruction.

While public interest is easily focused on the war cripple it is not so easily directed sympathetically to the case of workmen who are injured in the shops. These cases have been so common that they have attracted little attention. Yet they greatly outnumber the cases of soldiers permanently hurt in battle.

Stinging the Stinger

By John R. Godfrey

It sounds like a fairy story, but it's vouched for by an old friend of mine who never lies when the truth will answer—and he generally makes it do. It's just one of the exceptions which prove the rule.

It begins with the old, old story of the youthful and trusting inventor who was trimmed to a fare-you-well by his business partners manipulating the books and getting all his stock away from him. This isn't the strange part of it—it's happened hundreds of times—but it's the prelude, as they say in the theater, to the real and unbelievable part of the story.

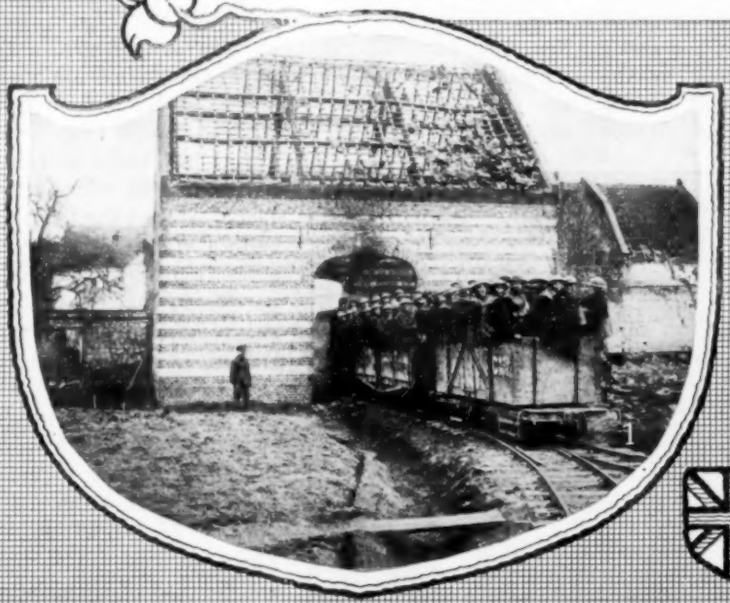
This young inventor was a shark on mouse traps that really worked. They sort of had a personality like a hunk of cheese and attracted the mice whether they were hungry or not. And so, while the h.b.p. (meaning heartless business partner) was selling mouse traps, making money and gloating in the regulation manner, the inventor got busy and outdid himself in the invention of a brand-new breed of mouse trap—with so many new ideas and attractions that the mice vied with each other for the privilege of being caught. Its strength of attraction was about in proportion to real live limburger as compared with cottage cheese. But before springing this world beater on the market another business friend of the inventor made overtures to the h.b.p. and secured the first mouse trap on a liberal royalty contract. It looked like easy money with none of the worries of manufacturing in these strenuous days when labor is beginning to sit up and take notice, and the h.b.p. fell for it. It looked so good that he even failed to note the absence of the minimum-royalty clause. The stage having been duly set, the first mouse trap was captured on a royalty basis, the new and doubly useful was sprung and began to sell like the proverbial hot cakes. When the h.b.p. inquired as to royalties he, like the newsboy and the apple, found there "wa'n't goin' to be no core" because they quit making the trap.

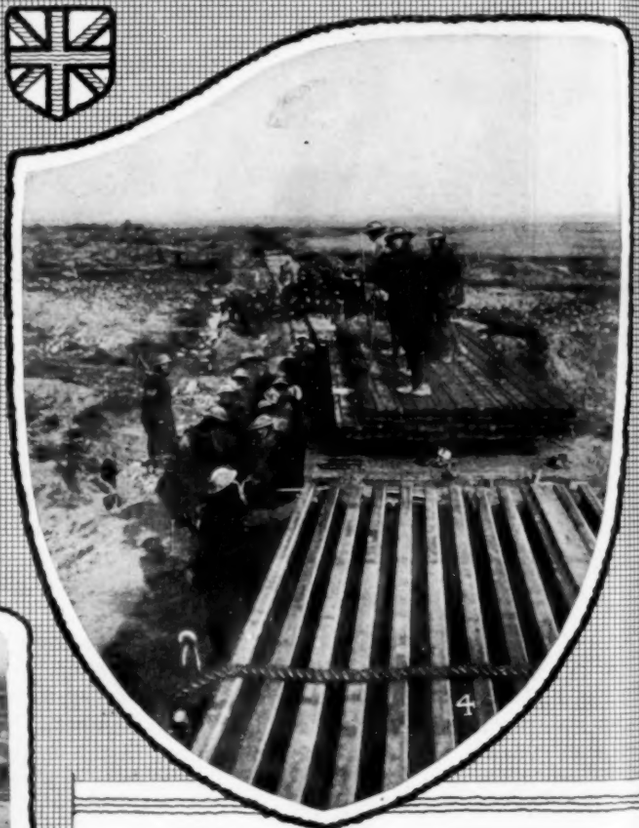
It's a low-down trick in any case. But it's been done to the poor inventor so many times it gives you a sort of unholy glee to see the biter bit.

There's one way to prevent this sort of thing, which has been modestly advocated at various times. This is to make all patents available to anyone who will pay a respectable royalty to the inventor. Everyone pays the same royalty, so there can be no monopoly. Quality and manufacturing methods would determine the selling price and the sales. The nearest approach to this is the law in various countries which makes it necessary to manufacture a patented article within three years—or some other given period.

Of course the real solution is to have everybody honest and willing to play the game squarely and with all the cards on the table. But it's going to take more than a league of nations to get this into active operation, and in the meantime we can get a little satisfaction whenever the smart Aleck who tries to put over a raw deal gets stung good and proper as was the h.b.p. in the mouse-trap deal. Once in a long time the h.b.p. does get the worst of it.

British Transportation

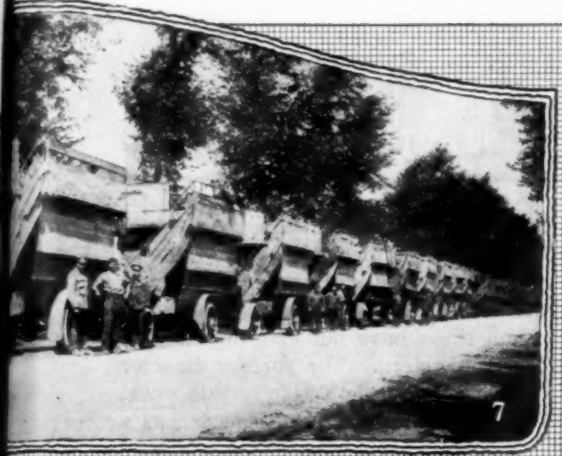


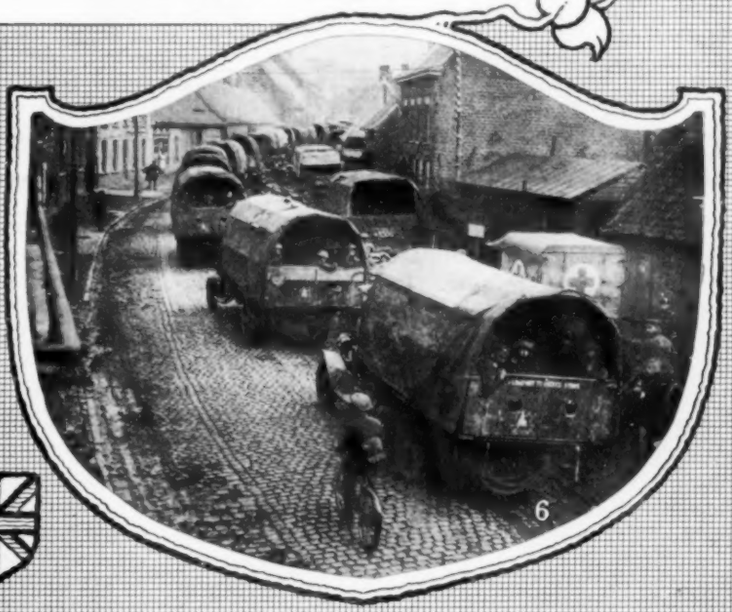


1, Railway Through a House.
2, British Motor Truck Transports.
3, Lifting Bridge to Pass a Boat.
4, Taking Rails to the Front.
5, Transporting Shells on Hand-Cars.

Methods in France

PHOTOS BY BRITISH PICTORIAL SERVICE





6, Motor Lorries Going to Front.
7, London Buses as Transports.
8, Transporting in Canal Boats.
9, Laying Railroad Track.
10, Clearing Debris-Covered Tracks.

RECONSTRUCTION NEWS

TIMELY INFORMATION *for* LIVE MACHINE SHOPS

ON ITS surface the chief purpose of the Smith-Sears Vocational Rehabilitation Act appears to be merely trade training. But careful examination will show much greater possibilities in it. The principal function of the law is education, and education of a different quality than that heretofore given or commonly understood. It is a type of education which goes to the heart of democracy—an education which will bring more opportunities and greater mobility and freedom.

If the Germans had won, industrial slavery instead of freedom would have been the lot of all men in all lands for an indefinite period. In the days of reconstruction now before us the defenders of America who have been disabled in the cause of industrial liberty must be our chief concern. These men must be so trained and so educated that they will be free to come, go, select or act in the employment they have chosen. Self-employment, one of the great ideals of democracy, will be advised whenever and wherever possible. In cases where this is not advisable they must be so completely trained as to insure for them the greatest possible measure of industrial freedom.

The Smith-Sears Act will, it is believed, remove, in a large measure, the great danger of allowing any one man or set of men to have the opportunity of dictating how another man shall work, how much he shall do, how much he shall be paid, when he shall work, when he shall not work and how long he shall work. It is believed that organized labor thoroughly understands the human problem of retraining the disabled soldiers and sailors and that it can be depended upon to make them welcome in every vocation which they may select for their life work.

The United States Employment Service

There is no doubt as to the good which can be accomplished by the United States Employment Service in the placing of soldiers back into industry and the shifting of others from war jobs into the paths of peaceful pursuits. But, as we have pointed out before, this cannot be accomplished without broad-visioned men in charge of the work, not only in Washington but in the district branches. Even with these it needs close cooperation between the manufacturers, labor organizations and the employment service, for it must be remembered that the service can neither create men nor jobs, but can only act as a clearing house to bring the men and the jobs together.

The community labor boards which have been established in various centers can be utilized to advantage in this work and can do much to assist the readjustment of employment, but they must be supported by efficient employment offices and these have not had the support they deserve from headquarters. The former director of the service is fortunately not now active in this work, but there are indications that the present officer has a real interest and a real understanding of the work in hand. Perhaps the weakest part in the organization at present is in the management of the largest and most important branch office—that of New York City. This office represents perhaps 10 per cent. of the total work of the country and needs one of the strongest men at the head of it. Instead of this, however, the former chief at Washington began its disruption before his removal and the work has gone on with amazing rapidity.

There was no doubt as to the good intention of the director who has just resigned; his past record is excellent in every way. But in common with many managers who are smitten with system and efficiency he did not and evidently could not understand that the problem of the United States Employment Service is a human problem and not one which can be measured by slide rule or guided solely by card indexes and mathematical formulas. Theoretically he seemed to grasp the idea, and according to a recent interview he was just beginning to see that it may be a permanent instead of a temporary institution.

The New York Office

Those familiar with the New York office know, however, that it became thoroughly disorganized in the short space of two months; that the trained personnel has been scattered and that the esprit de corps which was so noticeable under the state organization has almost disappeared. In spite of high-sounding phrases the office is not doing its job with the same real efficiency and understanding as before.

There seems to be no good reason why the various employment-service offices should not be operated by the various states under the supervisions of the Federal Employment Service. Local sympathy and coöperation can best be secured in this way, and in this case at least a much better handling of the whole matter was secured under the old order. Better salaries must be paid however, if they are to succeed, and the best talent must be secured for the work.

Whatever may be the outcome, however, it is absolutely necessary that the New York office be restored to somewhere near its old standing. This will be difficult because important work had been put in the hands of inexperienced men. If the new director can see the light and really grasp the human side of the problem he may succeed. It is not a question as to his ability; it is only a question of his fitting in this particular job.

We have entered on this particular case simply because it is the most important office in the country and one which will in a measure be looked upon as a model for the rest. The employment service can be of great help to the industries of the country in many ways. Every manufacturer should see that it serves his community in the way that is best for all concerned.

Preventing Price Depressions

Although we have felt sure that every precaution would be taken to prevent the disturbance of the price of various products by the dumping of large quantities of material purchased by the Army and Navy for their various needs it is gratifying to have further assurances from those in charge of this work. In a recent speech before the Chicago Association of Commerce L. H. Hartman, chief of the Surplus Property Division of the office of the director of Purchase and Storage, stated that no secret policy was to be pursued and that every means will be taken to have all those interested understand thoroughly the conditions regarding the sales.

We have his assurance that every possible effort will be exercised to avoid business casualties, sudden price depressions, sudden decrease of production and the consequent disturbance of labor conditions. The Army will, so far as possible, find a market for its surplus material outside of the usual channel. Arrangements have already been made for the disposal of a large amount of their surplus material to the Navy, the Post Office Department, the Department of the Interior, Panama Canal, the Red Cross, the Y. M. C. A., the Emergency Fleet and the Belgian Relief Commission. Arrangements are also being made with the Russian Bureau of the War Trade Board to send millions of dollars' worth of clothing to Siberia, and large orders for Montenegro, Ecuador and other foreign countries are under consideration. As an example of this several thousand trucks are being transferred to the Post Office Department and large quantities of other material will be transferred to the Forest Service of the Department of Agriculture and to other Government departments.

Nothing will be offered for sale until every possible consideration has been given as to the effect such offering will have on normal market conditions and on the maintenance of normal prices and labor conditions. Future depreciation is to be preferred to upsetting the present condition.

It is the purpose to divert everything as far as possible to its original and proper channels so that manufacturers need not regard it as being competitive. Wherever practical the manufacturer who furnished the article to the Government will have the first opportunity of repurchasing, so that none of his goods need reach the open market except through his own channels and by his own sales force.

The Purchase and Storage Division is well aware that after other wars jobbing or scalping concerns have sprung up overnight for the purpose of procuring Government surplus at ridiculously low prices and then reselling considerably below the market. This has always upset business, and it is fully realized that the elimination of all such projects is highly desirable. Conditions will not be allowed to arise where small groups of men can become especially familiar with operations respecting surplus stock and be in a position to make huge profits.

Hundreds of Inquiries

This department has already received hundreds of inquiries from concerns throughout the country that desire to purchase material from it. The law gives no authority to negotiate a private sale and all these requests must be denied. The department has in each case urged the purchase of the material asked for through regular sources. The delay in sending out a list of articles on hand has been intentional to some extent, as it was not desired to rush the placing of these goods on the market. A complete inventory of all supplies belonging to the Government is being taken, and it is hoped that definite information may be available about January 15. When this information is at hand and careful consideration has been given to the amount of material needed by the Army which must be maintained for some time the remainder will be disposed of in a slow and safeguarded manner so as to affect as little as possible the regular sources of supply, as this department fully realizes the serious consequences of disturbing conditions any more than is necessary.

Executives

By Rudolph Bloom

How many of us have ever stopped to think why is it that "there is plenty of room at the top" and why is it that a few of us lead but most of us are led? Shakespeare tells us that we are either born great, achieve greatness or have it thrust upon us, but no matter how greatness comes to us there are certain prime qualities we must possess to retain it.

Greatness means the ability to influence the minds, works and affairs of our fellow beings. A man may be a renowned leader in constructive work or he may be a notorious robber chief, but whether the one or the other he must possess the power to sway men to his purpose; in other words, an executive. We may not admire a political boss, but we must concede that he possesses attributes that make him a leader of men, much as we feel that were his energies directed by unselfish motives he could be more useful to society.

An executive is a man who never wastes time on details, but successfully delegates them to someone under him. In order to distinguish him from the "buck passer," the word "successfully" is used, because "buck passers" dodge responsibility and are never successful. The executive on the contrary accepts responsibility and the more of it he accepts the greater executive he is.

The executive is concerned only with results and receives credit for the capable performances of his underlings or censure for their failures. He is a

broad-gage man; he chooses his own organization and stands back of it, and if a member of it fails in his task he blames only himself for not having chosen the proper man.

If the sales of a company fall down it is the president's fault in that he did not choose the right sales manager, and in facing an irate board of directors he will be a big enough man to take upon himself the punishment. Or maybe it is a shop foreman who is taken to task for some spoiled work. True he did not himself spoil it, but he did not choose the right man to do the job; hence his the blame. If he is a "two-by-four" type of man he will try to shift the blame. Maybe the labor in the shop is inferior. However, if he can obtain results despite this handicap, all the more credit. He is a poor workman who blames his tools.

Dodge Bros., the automobile builders, were asked whether they could build recuperators for gun carriages, a job which every other manufacturer had turned down. They answered "Yes, what are they?" and then built them. They carried their message to Garcia not by asking how, but by just doing. This is another quality of an executive, namely, ability to perform tasks without asking how to do them. It is not "How should the new factory be built?" or "Should I use a hog-nose or a diamond-point tool in machining the casting?" Large or small questions, the executive knows only one command and that is Do!

A Very Odd Request

The president of a large firm once asked an applicant for a position to bring a baby carriage from the former's residence to his office. To be sure an odd request, but the applicant asked no questions, but brought the perambulator to the office in a few hours, together with a bill for $6 in taxicab fare. "If that chap had asked me how to get the baby carriage into the subway he would not have got the job, but it was worth $6 to me to know that I was hiring a man who could execute an order without asking why or how," were the president's words.

The executive has been reviewed up to now only from the standpoint of the performance of duties, which is synonymous with his relation to those placed over him. What must his relation be to those under him? What qualities give him the leadership of men? He must have their confidence by having a sound knowledge of his trade, profession or business, but without a domineering or intolerant attitude toward the ideas of those he commands. With his knowledge of the work he can pick the right men; then with his confidence in their ability he stimulates them to do their utmost. By bowing to the counsel of those skilled in special jobs he does not lower himself in the least, but creates a certain pride among his workers.

Many executives fail because they have no confidence in their assistants. They work many hours each day performing trival tasks merely because they believe in that rusty adage, "If you want a thing done well do it yourself," instead of modernizing it by saying "If you want a thing well done choose the right man to do it for you." A young man employed as assistant to a production manager of a large firm told his manager he was "going to the mat" with the purchasing department regarding some difficulty. The manager merely replied: "Do whatever you think is right and I'll back you to the limit." This statement implied that the assistant knew his job, and that the manager placed implicit confidence in his actions, and also that if a mistake were made the executive would shoulder the responsibility. One can easily realize the feeling of loyalty engendered by such a policy.

To be successful in managing men one must possess personality that creates in the subordinate a desire to do his chief a personal favor. An executive who acts on the theory of results by blind discipline is a Prussian. His workers are ruled by fear and they work mechanically. Familiarity breeds contempt, but courteous treatment, together with the proper degree of personal warmth, will win anybody. Merely being courteous and cold at heart is the incorrect attitude.

How often do we see subordinates shifting uneasily under the cold scrutiny of a fish-blooded boss! I recollect two superiors, one of whom, although thoroughly fair and conscientious, would allow you to stand at his desk for several minutes before he would deign to look up, and the other who no matter how busy or harassed always bade you a pleasant "Good morning" and asked you to sit down.

Both were capable executives, but the subordinates of the kindly man were his friends, and their loyalty to him was personal as well as dutiful. The cold-blooded man achieved results, to be sure, but those under him subconsciously hated him.

One may be just a section boss over a gang of "hunkies" or a president of a railroad, but the essence of good executive ability is the same in either case. Have confidence in yourself, in those over you and in those under you; let your relations with employer and employed be firm but tempered by the milk of human kindness, and even if you do not reach the heights of fame or power you will have the satisfaction of doing and causing others to willingly do for you.

Accurately Spaced Drilled Holes

By Willbur L. Coble

I recently discovered a method of spacing drilled holes which combines to some degree the accuracy of the button method of locating with the speed of the drilling machine.

The centers are located with the buttons in the regular way and a hardened-steel plate with a hole lapped to fit the buttons nicely is then clamped to the work with the hole fitting over each button in turn. After the plate is securely clamped the button that located it is removed and, using the plate as a jig, the hole is started with a drill of the same size as the hole in the plate.

Slip bushings may be made for holes smaller than the buttons, while for larger holes special buttons must be made, but if there is much of this work to be done the time saved by this method will warrant this extra work.

It is desirable after starting a hole to drill it through with a slightly smaller drill and finish it with a rose reamer that accurately fits the hole in the jig plate or one of the bushings. With a little ingenuity combinations of special buttons and bushings may be made to cover a wide range of work, and while the time saving at first may not be appreciable, as the stock of special tools accumulates the saving will become more apparent.

LATEST DEVELOPMENTS IN THE AUTOMOTIVE INDUSTRIES

Aircraft · Motor Trucks · Tractors

The General Motors Corporation has brought out two new tractor models, one known as model A, which will cost $900 and the other model D, which is priced at $450. It is expected that about 10,000 tractors of this model will be turned out during the next four months. The company's ultimate capacity will be in excess of 100,000 tractors a year. To take care of this tractor the General Motors Corporation is building a large plant at Janesville, Wis.

The Zenith carburetors used on the Hispano-Suiza motors are equipped with a manually operated barometric control called the altimeter, by the use of which the mixture can be maintained at the best proportions of air to fuel in order to obtain the best possible motor performance at various altitudes. The actual function of this attachment is to vary the pressure in the float chamber which changes the amount of gasoline fed to the motor.

French auto-truck manufacturers made considerable progress during the war in the development of variable venturi-tube carburetors without spring air valves or other moving parts. Backfiring when using a lean mixture is prevented by automatically covering the jet when the throttle is opened. When the gasoline level goes down in the carburetor bowl, the balance is restored by having the suction of the motor intake lift the cover from the jet until the carburetor bowl is refilled. This of course refers to a surface carburetor.

A noninflammable gas, officially termed "argon," for the use of balloons and dirigibles has been discovered, which will eliminate the hazard of fire and explosion that always has accompanied balloon operations where hydrogen gases have been used. The gas from which argon is obtained comes from wells at Petrolia, Tex., owned by the Lone Star Gas Co. A pipe 94 miles long is proposed to be laid from the wells to a plant at North Forth Worth, where the gas will be compressed into cylinders for shipment to the balloon fields. The cost of this plan is estimated at $2,000,000.

The New York automobile show will be held in Madison Square Garden and the Sixty-Ninth Regiment Armory Feb. 1 to 15. The passenger cars will be shown Feb. 1 to 8 and trucks Feb. 10 to 15. Interest in the show on the part of the automobile manufacturers is running high and the local dealers have been assured that the various makes of cars exhibited will be the latest type. In all probability the show this season will reveal many novel designs and features of construction as the direct result of the war. This applies especially to cars of the commercial type.

Owing to the wide difference of opinion in the steel trade in regard to prices the quick action of some of the steel producers to adopt the suggested reduction in steel prices came as a surprise to the buying trade, the belief being that producers would endeavor to maintain Government prices as long as possible. One argument advanced in favor of the reduction is that a lowering of prices will set a good example to the sellers of other commodities, which will help the market and vitalize business. On the other hand it may have the opposite effect if it is taken to indicate further reduction.

M. Maurice Houdaille, a French inventor, invented an adjustable car suspension to secure the same comfort in an automobile whether the load be the minimum of one passenger or maximum of five or six. The general idea of this invention is to increase the stiffness of the springs as the load is increased. The result is obtained by using an elongated groove instead of the eye at each end of the rear springs and moving the eyebolts with a lever or wheel mechanism to the desired position. With a minimum load the bolts are at the other extremities of the rear spring grooves, and as passengers are added the bolts are brought closer together; that is to say, nearer to the axle, thus stiffening the spring. The experimental work was carried out on a five-passenger Renault touring car, moving the bolts in five positions corresponding to the number of passengers. The links by which the eyebolts are operated are carried inside the frame members, do not change the appearance of the car and are connected to a lever placed near the driver's right hand.

A glimpse into the airplane industry of the future would reveal three groups of airplanes, namely, pleasure planes (single-passenger and two or more passenger, or touring); commercial planes (passenger, mail and cargo carrying), and military planes (fighting and day and night bombing). Owing to the high cost of manufacture and maintenance, pleasure airplanes present the same problems now, which have been so successfully solved by Mr. Ford for the automobile field. From the construction point of view the future pleasure airplane will require an absolutely sure-acting automatic stabilizer and a device to eliminate the dangers of landing. The commercial airplane is already in its trial period. The cost of operating a mail-carrying airplane is computed by the United States Post Office to be 35¾c. a mile. Without doubt the commercial airplane will be successfully developed by the Government or by one of our big corporations, keeping pace with which will be the mapping out of air routes, the erection of wireless signal stations, the establishment of harbors and landing places, etc. The military planes have made remarkable progress during the war and their future development will be bound up with that of the pleasure and commercial planes. Some of the difficulties to be overcome are a more efficient engine than the gasoline motor, a more efficient construction and form, a new propulsion mechanism and more improved safety devices.

A low-priced and most successful airplane, which is supposed to be equivalent to a Ford car, has been produced by Capt. James V. Martin. Distinctive features of this machine are the retractable chassis, which folds up like a bird folds its legs when in flight; the K-bar trussing to reduce the head resistance by eliminating struts and wires, and the wing-end ailerons having the advantage that they do not impair the efficiency of the aerofoil to which they are attached. The ailerons have a symmetrical double convex surface operated by means of a sliding rod running through the upper plane. The sliding movement of the rod, acting on a collar attached to the ailerons and having a spiral keyway through which a pin from the rod projects, causes a rotary movement of the ailerons, doing away with all exposed members generally used in the operation of ailerons. The upper plane has a 15-ft., the lower a 17-ft. 11¼-in. span, with a chord for both planes 3 ft. 6 in., having neither stagger nor dihedral. The fuselage has an over-all length of 10 ft. 10¾ in. with a maximum depth of 3.6¼ in. The airplane is driven by an air-cooled two-cylinder opposed "Gnat" A B C motor, developing 45 hp. at 1950 r.p.m., having a fuel consumption of 0.56 lb. per horsepower hour. The total weight of the machine is 350 lb., with sufficient fuel for a flight of two hours. The selling price is proposed to be $2000.

Sparks from the

Market in Argentina for American Railroad Equipment

A Number of Extensions to Be Constructed Which Will Amount to a Cost of About Seventy-Five Million Dollars

The complete systems of railroads in the republic of Argentina is of 36,003 kilometers and same is divided as follows: 21,312 kilometers of wide gage of 1676 mm. (6 ft. 5 in.); 2838 kilometers of medium gage of 1435 mm. (4 ft. 9½ in.), and 11,686 kilometers of 1000 mm. (3 ft. 4 in.).

The Argentinian government owns and manages 6320 kilometers, which is almost 8 per cent. of the total of 36,003 kilometers of railroads. The respective department which runs this part of the system of the government is known as the "Administraccion de los Ferrocarriles del Estado," and same is in charge of an administrator who presides over the board composed of a chief engineer, chief of exploitation and an auditor general. The administrator is appointed by the president of the republic subject to the approval of the International Sènate. The other employees are appointed by the administrator.

Every one of the various systems of railroads in the Argentinian republic is under the control of the "Direccion General de Ferrocarriles" (Argentinian Administration of Railroads), at the head of which must be an Argentinian engineer, who is under the direct supervision of the minister of public works.

During the last four and one-half years none of the railroads in Argentina have been able to receive materials, and at present are in great need of all the various articles used in such enterprises. It is estimated that during the two coming years the importation of these materials into the republic will amount to more than one hundred million dollars, and same will be used exclusively to replace all that which has been used up and for accumulation of the indispensable reserve stock.

A number of extensions will have to be constructed, and if those of the greatest urgency are taken into consideration it will be not less than 3000 kilometers and will amount to a cost of about $75,000,000. Of this amount 75 per cent. will be expended for the acquisition of materials.

The Argentinian railroads have purchased heretofore 95 per cent. of their materials in Europe, especially in England, Germany and Belgium, but as these countries will no doubt have to give some very close attention for some years to come to their own necessities at home, it is therefore obvious that the American manufacturers should become acquainted with the characteristics of such an important market in order to be able to introduce into Argentina American products.

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Employment for Ship Workers

The Newark Bay Shipyard at Port Newark, N. J., is offering employment to a large number of men in shipbuilding. It has established a school for training workmen, who receive about 50 cents an hour during training in various branches of shipbuilding, such as bolting-up, drilling and reaming, riveting, chipping, and caulking. One thousand men a month have been graduated from the school, after which they receive from 50 cents to 80 cents an hour, and on piecework, it is said, from $7 to $15 a day, depending upon the trade which they follow.

Employment is offered to men of the Army and Navy who have received their discharge as well as other unemployed men, and whether they have worked in a shipyard or not, through the methods of training, in four to six weeks' time they can become skilled workmen.

Business Items

The Wellman-Seaver-Morgan Co., Cleveland, Ohio, has opened a San Francisco office at 415-417 Rialto Building in charge of Norman S. Ross.

Morris L. Cooke, Horace K. Hathaway, Boyd Fisher, Clyde L. King, Keppele Hall and John H. Williams have opened an office as consulting engineers in the Finance Building, South Penn Sq., Philadelphia, Penn.

The Skelton Sales Co., Syracuse, N. Y., will change its name to Skelton Tool Co. and will increase its capital stock to $100,000. It has purchased the plant of the Will & Baumer Co., Syracuse, and will move to the new location about Feb. 1.

The Shepard Electric Crane and Hoist Co. has opened an office in the new Lexington Building, Baltimore, Md. This office will be in charge of Norman P. Farrar, who for a number of years has been district manager of the Philadelphia territory.

The F. L. Schmidt Co., manufacturer of envelope and special machinery, 11th Ave. and 21st St., New York, by the action of the stockholders of the corporation and through a provision of the general corporation law of the State of New York has changed its name to F. L. Smithe Machine Co., Inc.

Engineers' Club of Philadelphia to Hold Interesting Meeting

The Engineers' Club of Philadelphia, 1317 Spruce St., Philadelphia, Penn., will hold its regular monthly meeting on Tuesday, Jan. 21, 1919, at Witherspoon Hall. A paper entitled "War Aviation in Retrospect, Commercial Aviation in Prospect," by G. Douglas Wardrop, editor of the *Aerial Age Weekly*, will be read. This paper will be illustrated with motion pictures.

Mr. Wardrop will speak of his experiences in France, Belgium and England during the summer of 1918, at the time when the aerial activities of the Allies were at their height; his participation in distance bomb-raiding exploits; his observations of some thrilling aerial battles and something of trench warfare on the Belgian front; his opportunities to study manufacturing methods in England and France, to review their plans for the commercial development of aviation and to discuss the subject with many authorities in France and England.

The members of the club and of affiliated societies are privileged to invite ladies to the meeting.

Following is a schedule of the Tuesday-noon luncheons up to and including Feb. 4, 1919: Jan. 14, Col. James B. Curtis, president of the American Manganese Bronze Co., "The Legal Engineer;" Jan. 21, Lieut.-Col. E. B. Morden, U. S. A., constructing quartermaster, Philadelphia, "The Construction Division of the Army;" Jan. 28, P. H. W. Ross, president of the National Marine League, "Public Participation in Maritime Development;" Feb. 4, William S. Twining, director of the Department of City Transit, Philadelphia, "Financing City Improvements."

* * *

Tin Imports In October

Imports of metallic tin in October were 14 per cent. less than in August, decreasing from 5156 tons to 4443 tons. Only 50 tons of ore were received as against 683 in September. Pig tin dropped from 10,500,000 lb. in September to 10,000,000 lb. in October. This decrease occurred in shipments from the Dutch East Indies and from Hongkong, while England and the Straits each registered an increase.

For the 10 months ending Oct. 31, 1918, imports of metallic tin amounted to 64,723 tons as against 60,432 tons in the corresponding period of 1917. Shipments this year from the Straits Settlements and from Hongkong are much heavier than in 1917, while shipments from England and from the Dutch East Indies are much lighter.

World's Industrial Forge

By E.C.Porter, News Editor

New Association Incorporated In Dayton, Ohio

The Tool Manufacturers' Association of Dayton, Ohio, was incorporated under the laws of the state of Ohio on Dec. 16, 1918, with a charter membership of 30 manufacturers, and the following officers were elected: O. Garrison, Garrison Machine Works, president; J. S. Kepler, Automatic Machine Co., vice president; E. F. Moore, Moore-Eastwood Manufacturing Co.; treasurer. These officers, together with W. H. McBarron, McBarron-Mitchell Tool and Manufacturing Co., and Lee A. Jones, Vulcan Tool Co., constitute the board of trustees. Charles W. Saffell has been employed as secretary of the association with an office at 1200 U. B. Building.

The purpose of the association is the maintaining of the present high standard of efficiency which has been developed in the industry in Dayton and also by educational propaganda to better inform the trade of the large resources which are available in the tool industry in that city.

Personals

LIEUT. J. B. HOWELL has been mustered out of the Artillery Service and has rejoined the Bound Brook Oil-less Bearing Co. in his former position.

HUGO BURGMANN, formerly secretary and general manager of the Batavia Shell Co., Batavia, N. Y., has been elected general manager of the Beaver Tool and Machine Co., Newark, N. J.

J. J. MCKEE, formerly New York manager of the C. A. Dunham Co., Marshalltown, Iowa, has left the company to take up his work with the Machinery Utilities Co., 501 Fifth Ave., New York.

A. M. JORALEMON has been appointed purchasing agent of the American Ever Ready Works of the National Carbon Co., Inc., Long Island City, N. Y., to succeed J. W. VOORHIS, who resigned recently.

G. J. KELLER has recently become a member of the sales force of the Knox-Andresen Co., Pittsburgh, Penn., having been formerly associated with the Westinghouse Electric and Manufacturing Co., Pittsburgh.

PERCY A. MCKITTERICK, for 20 years with the Saco-Lowell Shops and the Lowell Machine Shop, has left to become assistant treasurer of the Parks-Cramer Co., Fitchburg, Mass. The Parks-Cramer Co. is a recent consolidation of two well-known firms, the G. M. Parks Co., of Fitchburg, Mass., and the Stewart W. Cramer, Charlotte, N. C.

GEORGE S. BLAKENHORN has resigned from the American International Shipbuilding Corporation as engineer of steam machinery and has gone to the Wilson-Snyder Pumping Machinery Co. as engineer of the Philadelphia, Penn., district.

P. E. FRANCIS, who has in the past conducted a railroad and industrial equipment business under the name of and in conjunction with Edward Jobbins, has severed his connection with Mr. Jobbins and his business in the future will be conducted under the name of P. E. Francis & Co., Marquette Building, Chicago, Ill.

HORACE N. TRUMBULL, who recently received his discharge from the Engineers Officers' Training School at Camp A. A. Humphries, Va., has been appointed advertising manager of the Wellman-Seaver-Morgan Co., Cleveland, Ohio. Before entering the service Mr. Trumbull was advertising manager of the SKF Ball Bearing Co., Hartford, Conn.

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Dates of Automotive Meetings, Shows and Conventions

Readers of the *American Machinist* should preserve the following information for future reference, as it gives the dates of meetings of the Society of Automotive Engineers, motor shows, tractor shows and conventions to be held during the year 1919:

S. A. E. MEETINGS

Feb. 4-6.—New York. Winter meeting. Society of Automotive Engineers, Engineering Societies' Building.
Feb. 6.—Victory dinner, Hotel Astor, New York.
Feb. 5.—Minneapolis Section, S. A. E., Hotel Radisson. "Radiator Cooling Fans."
Mar. 5.—Minneapolis Section, S. A. E., Hotel Radisson. "Tractor Service and Sales."
Apr. 2.—Minneapolis Section, S. A. E., Hotel Radisson. "Implements Designed for Tractor Belt Power and Their Characteristics."

MOTOR SHOWS

Jan. 11-18.—Los Angeles, Cal. Automotive Exposition.
Mar. 1-8.—Detroit, Mich. Detroit Automobile Dealers' Association. H. H. Shuart, manager.
Jan. 24-30.—Milwaukee, Wis. Eleventh annual meeting. Milwaukee Automobile Dealers, Inc., Auditorium. Bart J. Ruddle, manager.
Jan. 25-Feb. 1.—Chicago. Passenger cars, Coliseum.
February.—Grand Rapids, Mich. Grand Rapids Automobile Business Association. E. T. Conlon, manager.
Feb. 1-15.—New York. Automobile Dealers' Association. Charles A. Stewart, manager, Hotel Woodward, Broadway and 55th Street.
Feb. 3-5.—Chicago. Trucks, Coliseum.
Feb. 15-22.—Louisville, Ky. Louisville Auto Dealers' Association.
Feb. 15-22.—Newark, N. J. N. J. Auto Exhibition Co. Claude Holgate, manager.
Feb. 15-22.—Minneapolis, Minn. Minne-

(Continued on page 92)

Difference Between War-Risk Insurance and Compensation

Secretary Glass Says It Is Not Necessary to Prove Dependency to Collect Insurance, but Proof Is Required in Compensation Cases

Considerable confusion and much misunderstanding seem to prevail among the relatives and beneficiaries of men in the military and naval service as to their rights under the war-risk insurance act. Many mothers and fathers named as beneficiaries of the Government insurance applied for by their sons have gained the impression that they must prove dependency in order to receive payments of insurance. This is an entirely erroneous impression, probably due to a confusion of the insurance and compensation provisions of the act of Congress of Oct. 6, 1917, and to a mistaken assumption that the terms "insurance" and "compensation" are used interchangeably, whereas they represent two separate and distinct benefits.

Insurance is payable regardless of any dependency, and a beneficiary designated in an application for Government insurance, if within the permitted class of spouse, child, grandchild, parent, brother or sister, is entitled to receive the insurance in monthly installments without proving any dependency upon the insured.

Compensation. however, which is separate and apart from insurance and takes the place of the pensions provided under the old pension system, is payable only to a wife, child, dependent mother or dependent father of a man who is disabled or dies as a result of injury suffered or disease contracted in the line of duty while employed in the active service. Compensation may be payable in addition to insurance, but a mother or father must prove actual dependency in order to receive monthly payments of compensation, although they will receive the insurance in monthly installments if named as the beneficiary thereof whether they are dependent or not.

No dependency need be shown by any beneficiary in order to receive the Government insurance, but a mother or father must prove actual dependency upon their deceased son for the necessaries of life in order to receive the additional payment of compensation.

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Buys Acreage for Huge Plant

The Standard Steel Tube Co., Toledo, Ohio, has purchased 40 acres of land in the outskirts of Toledo and will begin the construction of the plant and

homes for workers as soon as the ground can be broken in the spring. It is stated that the project will entail the expenditure of more than a half million dollars.

In addition to a huge factory with a capacity equal to three or four times that of its present plant a civic center and housing plan for employees is to be included.

Seven acres of the site is in timber and it is purposed to turn this into a park for the employees. A civic center having a library and a motion-picture theater are features of the plan. Twelve acres are to be platted and homes erected for workers.

(Continued from page 91)

apolis Auto Trade Association. Walter B. Wilmot, manager.

Feb. 17-22.—Des Moines, Iowa. Tenth annual meeting, Des Moines Automobile Dealers' Association. C. G. Van Vliet, manager.

Feb. 15-22.—Albany, N. Y. Albany Automobile Dealers' Association. State Armory.

Feb. 17-24.—Passenger cars; Feb. 24-27, trucks. South Bethlehem, Penn. Lehigh Valley Auto Shows Co. J. L. Elliott, manager.

Feb. 24-Mar. 1.—Kansas City, Mo. Kansas City Motor Dealers' Association. E. E. Peake, manager.

March.—Great Falls, Mont. Montana Automobile Distributors' Association.

March.—Philadelphia, Penn. Philadelphia Automobile Trade Association. Passenger cars.

Mar. 3-8.—Columbus, Ohio. Columbus Automobile Show Co., Memorial Building. W. W. Freeman, manager.

Mar. 3-8.—Buffalo, N. Y. Buffalo Automobile Dealers' Association.

Mar. 1-10.—San Francisco, Calif. Motor Car Dealers' Association. G. A. Wahlgreen, manager.

Mar. 10-15.—Syracuse, N. Y. Syracuse Automobile Dealers' Association. Harry T. Gardner, manager.

Second or third week March.—St. Louis, Mo. St. Louis Auto Manufacturers and Dealers' Association. Robert E. Lee, manager.

Mar. 15-22. — Boston, Mass. Boston Automobile Dealers' Association. Chester I. Campbell, manager.

Mar. 22-29, passenger cars; Apr. 1-5, trucks, Brooklyn. Brooklyn Motor Vehicle Dealers' Association. I. G. Kirkham, manager.

Third week March.—Trenton, N. J. Trenton Auto Trade Association. John L. Brock, manager.

March.—Pittsburgh Automobile Dealers' Association of Pittsburgh. John J. Bell, manager.

March.—Utica, N. Y. Utica Motor Dealers' Association. W. W. Garabrant, manager.

Feb. 15-22.—Cleveland, Ohio. Cleveland Auto Show Co. Fred H. Caley, manager.

Apr. 5-12. — Montreal, Can. — National Motor Show of Eastern Canada, Victoria Rink. T. C. Kirby, manager.

Not Decided.—Bridgeport, Conn. Auspices of City Battalion. B. B. Steiber, manager.

Not Decided.—Harrisburg, Penn. Harrisburg Motor Dealers' Association. J. Clyde Myton, manager.

Not Decided.—Hartford, Conn. Hartford Automobile Dealers' Association.

Not Decided.—Indianapolis, Ind. Indianapolis Auto Trade Association. John B. Orman, manager.

Feb. 10-15.—Kansas City, Mo. Kansas City Motor Dealers' Association. E. E. Peake, manager.

TRACTOR SHOWS

Feb. 10-15.—Kansas City, Mo. Fourth Annual Tractor Show. Sweeney Building. Kansas City Tractor Club. Guy H. Hall, secretary.

Feb. 18-22.—Wichita, Kan. Annual Mid-West Tractor and Thresher Show. Wichita Tractor and Thresher Club. Forum.

CONVENTIONS

Feb. 4-6.—New York. Meeting. Society Automotive Engineers.

Feb. 25-28.—New York. Sixteenth annual convention. American Road Builders' Association.

Obituary

JOHN B. PALIZZA, late secretary of the Langelier Manufacturing Co., Arlington, Cranston, R. I., died on Dec. 25, 1918.

J. F. RENO died on Dec. 19, 1918, from influenza, followed by pneumonia. Mr. Reno was chief engineer of the Root & Van Dervoort Engineering Co., East Moline, Ill., and had been with this company for the past 12 years.

CHARLES W. ISBELL, chairman of the board of directors of the Isbell-Porter Co., manufacturer of gas-making machinery and builder of gas tanks, died on Dec. 24, 1918, at his home in New York in his eighty-eighth year. He was born in New Haven, Conn.

Catalogs Wanted

Caron Brothers, manufacturers of turned and stamped metal goods, 233-239 Bleury St., Montreal, Canada, desire to receive catalogs from various machinery manufacturers.

Trade Catalogs

Standardized Leather Belting. The Graton & Knight Manufacturing Co., Worcester, Mass. Catalog. Pp. 38; 5 x 7½ in. Pages 3 to 6 give the history and advantages of standardization. Pages 8 to 22 show a standardized series of leather belting, and pages 23 to 30 give tables of belting standards for various industries.

Lathes. The Seneca Falls Manufacturing Co., Inc., Seneca Falls, N. Y. Catalog No. 27. Pp. 56; 9 x 6 in. A number of illustrations are given of the "Star" screw-cutting engine lathe, together with specifications and attachments for same. Several pages are taken up with illustrations of lathe parts; also a list of users of "Star" lathes.

Mechanics' Tools. The Cincinnati Tool Co., Norwood, Cincinnati, Ohio. Catalog. Pp. 56; 10 x 6¾ in. Loose-leaf catalog illustrating and giving the prices of various tools for mechanics, such as augers, brad awls, wrecking bars, bits, chisels, clamps, file cleaners, cutters, drills, drivers, gage bits, punches, wrenches, and other tools.

Pneumatic High Speed Hammer. H. Edsil Barr, engineer, Erie, Penn. Circular. Pp. 6; 3½ x 8 in. Information and description of the Barr pneumatic high-speed hammer. The circular will be sent on request to plant managers, superintendents, purchasing agents, etc.

Friction Clutches. Williams Foundry and Machine Co., 54-56 Cherry St., Akron, Ohio. Catalog. Pp. 32; 6 x 9 in. This catalog illustrates a number of friction clutches and clutch parts. Line drawings for ordering and tables of dimensions, sizes, etc., are given.

Drills. Buffalo Forge Co., Buffalo, N. Y. Catalog, Section No. 210. Various types of drills for a great variety of requirements are reproduced.

"Universal" Slitting Shear, Punch and Bar Cutter. Buffalo Forge Co., Buffalo, N. Y. Catalog, Section No. 325. Half-tone illustrations and a description are given together with tables and specifications.

Portable Electrical Tools. The United States Electrical Tool Co., Cincinnati, Ohio. Catalog No. 17. Pp. 78; 6 x 9 in. This catalog contains illustrations of electrical hand or breast drilling machines, radial drilling machines, grinding machines and buffing outfits of various types and sizes. A description and a table of type, volt, dimension, weight, horsepower and speed and a code of words are given.

The Fay Automatic Lathe. Jones & Lamson Machine Co., Springfield, Vt. Cloth-bound book. Pp. 85; 6¼ x 9¼ in. Fifty detail illustrations, both line and half-tone, of different types of machines and some examples of the work accomplished on the Fay automatic lathe are shown. The two last pages give some views and a description of the plant.

Reamers. Gisholt Machine Co., Madison, Wis. Circular. Pp. 4; 8½ x 11. Giving the prices and dimensions of shell reamers, hand reamers, taper, shank and chucking reamers and a part list of Gisholt reamer users.

Machines-Outils Americaines (American Machine Tools). Aux Forges de Vulcain, 3 Rue Saint Denis, Paris, France. Catalog. About 300 8 x 10 pages; fully illustrated. Bound in flexible, red leather. This is a very complete catalog of the various American machine tools handled in France by Aux Forges de Vulcain. It will be of interest to almost anyone doing or expecting to do business in France, and of aid to many whose knowledge of French machine-tool terms is limited. Various tools described include milling machines, and their attachments, lathes, turret lathes, plain drilling machines, multiple-spindle and gang-drilling machines, grinding machines, boring mills, shaping machines, planing machines, hacksaws, power hammers, power shears, bending machines, marking machines, bolt cutters and others.

New Publications

Industry.—A magazine edited and published by Henry Harrison Lewis, Wilkens Building, Washington, D. C., Vol. 1, No. 1. Semimonthly. Subscription price, $2 a year.

The purpose of *Industry* is to interpret current events, whether they be financial, economic, political or otherwise. It will follow up legislation and diagnose its meaning, its effect on the nation and its relationship to the great manufacturing and industrial problems of the day. *Industry* further purposes to keep the manufacturer, business man, banker and voter advised of conditions, and where possible to suggest remedies for the things that are of adverse import in the week-to-week developments.

Instincts in Industry.—By Ordway Tead. Two hundred and twenty-two 5 x 7½-in. pages. Published by Houghton Mifflin Co., Boston Mass.

This is an extremely interesting study of the psychology of workers in different industries and is directly in line with the present tendency to recognize the human qualities as well as, or bearing on, the productive possibilities of the men and women in industry. The 10 instincts considered are: Parental; sex; workmanship; acquisitiveness or possession; self-assertion; self-abasement or submissiveness; the herd instinct; pugnacity; the play impulse and the instinct of curiosity.

These take in about all the attributes of the individual, and examples from actual experience are given to illustrate each instinct and to show how each affects the individual worker, his work, his attitude toward his employer, toward his fellow worker and toward the community. No one who comes in contact with or handles labor in any way can fail to find information of value in this little book. It is full of suggestions which can be of great value to the student of this greatest of modern problems, the harmonizing of industrial forces for the greatest good of the nation.

The author cites cases from actual observation to bear out all of these instincts and to show their effect on industry. It seems evident, says the author, that the undercurrents of unrest and discontent which come to the surface with increasing frequency have had their source in an unconscious but effective repression of human aspiration and desire. The release of this energy and vigor, which is needed to clear the air, will not come until we see human nature as it is. He believes that the mind of the worker is grievously misunderstood; that a common knowledge of the motives and attitudes of its manual workers is most imperative; that we have too little real understanding of them. Efforts toward social justice and industrial democracy can hardly be most effective unless we understand the point of view of the worker.

This book should be read by every man and woman who is interested in the employment problem. The time has gone by when we can classify workers by numbers only—we must know their mental background and understand their attitude toward the many problems of the day.